

2000
MAINTENANCE
SERVICE
SUPPLEMENT



FE290 GASOLINE VEHICLES

MANUAL NUMBER 102067508

EDITION CODE 0500A00000

FOREWORD

Club Car vehicles are designed and built to provide the ultimate in performance efficiency; however, proper maintenance and repair are essential for achieving maximum service life and continued safe and reliable operation.

This supplement provides detailed information for the maintenance and repair of FE290 gasoline vehicles and should be used in conjunction with the appropriate maintenance and service manual.

If you do not have the appropriate maintenance and service manual, you may order one from your local Club Car representative. Maintenance and service manuals available include:

2000 DS Golf Car Maintenance and Service Manual

Publication Part No. 102067501

2000 Turf/Carryall Vehicle Maintenance and Service Manual

Publication Part No. 102067502

2000 Villager/TransPorter Vehicle Maintenance and Service Manual

Publication Part No. 102067503

This supplement and corresponding maintenance and service manual should be thoroughly reviewed prior to servicing the vehicle. The procedures provided herein must be properly implemented, and the DANGER, WARNING, and CAUTION statements must be heeded.

This manual was written for the trained technician who already possesses knowledge and skills in electrical and mechanical repair. *If the technician does not have such knowledge and skills, attempted service or repairs to the vehicle may render the vehicle unsafe.* For this reason, Club Car advises that all repairs and/or service be performed by an authorized Club Car distributor/dealer representative or by a Club Car factory-trained technician.

It is the policy of Club Car, Inc. to assist its distributors and dealers in continually updating their service knowledge and facilities so they can provide prompt and efficient service for vehicle owners. Regional technical representatives, vehicle service seminars, periodic service bulletins, maintenance and service manuals, and other service publications also represent Club Car's continuing commitment to customer support.

This supplement, used in conjunction with the appropriate maintenance and service manual, covers all aspects of typical vehicle service; however, unique situations do sometimes occur when servicing a vehicle. If it appears that a service question is not answered in this manual, you may write to us at: Club Car, Inc.; P.O. Box 204658; Augusta, GA 30917; Attention: Technical Services, or contact a Club Car Technical Service Representative at (706) 863-3000, ext. 3580.

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WARNING

- READ SECTION 1 – SAFETY IN THE MAINTENANCE AND SERVICE MANUAL BEFORE ATTEMPTING ANY SERVICE ON THIS VEHICLE.
- BEFORE SERVICING VEHICLE, READ COMPLETE SECTION(S) AND ANY REFERENCED INFORMATION RELEVANT TO SERVICE OR REPAIR TO BE PERFORMED.

NOTE

- THIS SUPPLEMENT REPRESENTS THE MOST CURRENT INFORMATION AT TIME OF PUBLICATION. CLUB CAR, INC. IS CONTINUALLY WORKING TO FURTHER IMPROVE ITS VEHICLES AND OTHER PRODUCTS. THESE IMPROVEMENTS MAY AFFECT SERVICING PROCEDURES. ANY MODIFICATION AND/OR SIGNIFICANT CHANGE IN SPECIFICATIONS OR PROCEDURES WILL BE FORWARDED TO ALL CLUB CAR AND CARRYALL DISTRIBUTORS/ DEALERS AND WILL, WHEN APPLICABLE, APPEAR IN FUTURE EDITIONS OF THIS SUPPLEMENT.
- DAMAGE TO A VEHICLE OR COMPONENT THEREOF NOT RESULTING FROM A DEFECT OR WHICH OCCURS DUE TO UNREASONABLE OR UNINTENDED USE, OVERLOADING, ABUSE, OR NEGLECT (INCLUDING FAILURE TO PROVIDE REASONABLE OR NECESSARY MAINTENANCE AS INSTRUCTED IN THE VEHICLE OWNER'S MANUAL), ACCIDENT OR ALTERATION, INCLUDING INCREASING VEHICLE SPEED BEYOND FACTORY SPECIFICATIONS OR MODIFICATIONS WHICH AFFECT THE STABILITY OF THE VEHICLE OR THE OPERATION THEREOF, WILL VOID THE WARRANTY.
- CLUB CAR, INC. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS AND DESIGNS AT ANY TIME WITHOUT NOTICE AND WITHOUT INCURRING ANY OBLIGATION OR LIABILITY WHATSOEVER.
- THERE ARE NO WARRANTIES EXPRESSED OR IMPLIED IN THIS SUPPLEMENT. SEE THE LIMITED WARRANTY FOUND IN THE VEHICLE OWNER'S MANUAL OR WRITE TO CLUB CAR, INC.

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SECTION 10 – PERIODIC MAINTENANCE

10

DANGER

- **BATTERY – EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM THE VEHICLE AND SERVICE AREA. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR A FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.**
- **BATTERY – POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:**
 - **EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.**
 - **INTERNAL: DRINK LARGE QUANTITIES OF WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.**
 - **EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL A PHYSICIAN IMMEDIATELY.**
- **GASOLINE – FLAMMABLE! EXPLOSIVE! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM VEHICLE AND SERVICE AREA. SERVICE ONLY IN A WELL-VENTILATED AREA.**
- **DO NOT OPERATE VEHICLE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. THE ENGINE PRODUCES CARBON MONOXIDE, WHICH IS AN ODORLESS, DEADLY POISON.**

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THE VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW THE PROCEDURES EXACTLY AS STATED IN THIS SUPPLEMENT, AND HEED ALL **DANGER**, **WARNING**, AND **CAUTION** STATEMENTS LISTED IN THIS SUPPLEMENT AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- IMPROPER USE OF THE VEHICLE OR FAILURE TO PROPERLY MAINTAIN IT COULD RESULT IN DECREASED VEHICLE PERFORMANCE OR SEVERE PERSONAL INJURY.
- ANY MODIFICATION OR CHANGE TO THE VEHICLE WHICH AFFECTS THE STABILITY OR HANDLING OF THE VEHICLE, OR INCREASES MAXIMUM VEHICLE SPEED BEYOND FACTORY SPECIFICATIONS, COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.
- CHECK THE OWNER'S MANUAL FOR PROPER LOCATION OF ALL VEHICLE WARNING DECALS AND MAKE SURE THEY ARE IN PLACE AND ARE EASY TO READ.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHEN SERVICING THE VEHICLE.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- HOT! DO NOT ATTEMPT TO SERVICE HOT ENGINE OR EXHAUST SYSTEM. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE BURNS.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- FRAME GROUND – DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRIC WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE FRAME, ENGINE, OR OTHER METAL COMPONENT.
- TURN THE KEY SWITCH TO **OFF**, REMOVE THE KEY, CHOCK THE WHEELS AND PLACE THE FORWARD/REVERSE HANDLE IN **NEUTRAL** PRIOR TO SERVICING THE VEHICLE.

WARNING CONTINUED ON NEXT PAGE. . .

⚠ WARNING

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (–) FIRST (**FIGURE 10-1, PAGE 10-2**).
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- TURN FUEL SHUT-OFF VALVE TO CLOSED (OFF) (**FIGURE 10-4, PAGE 10-6**).
- DO NOT WORK ON VEHICLE POWERTRAIN OR UNDER THE CARGO BED WHEN IT IS LOADED.
- FOR VEHICLES WITH CARGO BEDS, REMOVE ALL CARGO BEFORE RAISING THE BED. DO NOT CLOSE BED UNTIL ALL PERSONS ARE CLEAR OF CARGO BED AREA. KEEP HANDS CLEAR OF CRUSH AREA BETWEEN BED AND SEAT BACK SUPPORT. DO NOT DROP CARGO BED; LOWER GENTLY AND KEEP ENTIRE BODY CLEAR. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SEVERE PERSONAL INJURY.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, SET THE PARK BRAKE WHEN LIFTING THE FRONT OF THE VEHICLE, UNLOAD THE CARGO BED AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. USE APPROVED JACK STANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.

GENERAL INFORMATION

To ensure trouble-free vehicle performance, it is very important to follow an established preventive maintenance program (regularly scheduled service, even though the vehicle is functional). Regular and consistent vehicle maintenance can prevent vehicle down-time and expensive repairs that result from neglect. Any vehicle not functioning correctly should be removed from use until it is properly repaired. This will prevent further damage to the vehicle and avoid the possibility of injury due to unsafe conditions.

Contact your local authorized Club Car distributor/dealer to perform all repairs and semiannual and annual periodic service.

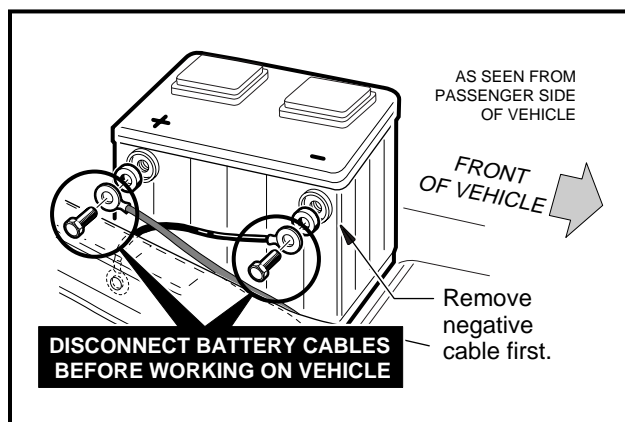


Figure 10-1 Battery Cable Removal

DAILY PRE-OPERATION SAFETY CHECKLIST

Inspect and drive the vehicle, using the Pre-operation Checklist and Performance Inspection in Section 3 in the appropriate maintenance and service manual as a guide to check the following items:

- Vehicle warning decals
- Brake system

- Park brake
- Reverse warning buzzer
- Steering and linkages
- Proper acceleration and maximum speed

In addition, check the items listed below:

- Tires: Visually inspect for wear, damage and proper inflation.
- Exhaust system: Check for leaks.
- Forward/Reverse shifter: Check for proper operation. **See Controls, Section 3 in the appropriate maintenance and service manual.**
- Fuel system: Check fuel tank, lines, cap, pump, fuel filters and carburetor for fuel leakage.

PERIODIC SERVICE SCHEDULE

WARNING

- SERVICE, REPAIRS AND ADJUSTMENTS MUST BE MADE PER INSTRUCTIONS IN THE MAINTENANCE AND SERVICE MANUAL AND THIS SUPPLEMENT.

NOTE

- IF THE VEHICLE IS CONSTANTLY SUBJECTED TO HEAVY USE OR SEVERE OPERATING CONDITIONS, THE PREVENTIVE MAINTENANCE PROCEDURES SHOULD BE PERFORMED MORE OFTEN THAN RECOMMENDED IN THE PERIODIC SERVICE AND LUBRICATION SCHEDULES.
- BOTH THE PERIODIC SERVICE SCHEDULE AND THE PERIODIC LUBRICATION SCHEDULE MUST BE FOLLOWED TO KEEP THE VEHICLE IN OPTIMUM OPERATING CONDITION.

PERIODIC SERVICE SCHEDULE

REGULAR INTERVAL	SERVICE	
Monthly Service by Owner or Trained Technician	Engine	Check engine oil level; Change as required. See Lubrication Schedule on page 10-4. Dispose of used oil properly.
		Check engine cooling air intake; clean as necessary. Visually inspect the unshrouded area around engine exhaust for grass and debris and clean as necessary.
	Tires	Check air pressure and adjust as necessary. See Vehicle Capacities Chart on page 10-5.
	General Vehicle	Wash engine compartment and underside of vehicle. Do not wash engine when hot. Dispose of waste water properly.
Semiannual Service by Trained Technician Only (Every 50 hours of operation or every 100 rounds for golf cars).	Battery	Clean terminals and wash dirt from casing. Check electrolyte level. See Battery in Section 12 on page 12-26
	Front Wheel Alignment and Camber	Check and adjust as required. See Section 7 in the appropriate maintenance and service manual.
	Electrical wiring and connections	Check for tightness and damage.
Periodic Service Schedule continued on next page...		

PERIODIC SERVICE SCHEDULE

REGULAR INTERVAL	SERVICE	
Semiannual Service by Trained Technician Only, Continued	Brake System	Check brake shoes; replace if necessary. See Section 6 in the appropriate maintenance and service manual.
		Lubricate brake slides per Periodic Lubrication Schedule. See also Section 6 in the appropriate maintenance and service manual.
		Check brake cables for damage; replace as required.
Annual Service by Trained Technician Only (Every 100 hours of operation or every 200 rounds for golf cars).	Engine	Check for leaks around gaskets, fill plugs, etc.
	Engine Air Intake System	Inspect, clean, and regap spark plug; replace if necessary.
		Check air filter element; clean or replace if necessary. Dispose of used filter element properly.
		Check clamps for tightness; check hose for cracks.
	General Vehicle	Check for loose hardware and tighten as required.
Two-year Service by Trained Technician Only (Every 200 hours of operation or every 400 rounds for golf cars)	Fuel Filters	Replace. Dispose of used filters properly.

⚠ WARNING

- IF ANY PROBLEMS ARE FOUND, DO NOT OPERATE THE VEHICLE UNTIL REPAIRS ARE MADE. FAILURE TO MAKE NECESSARY REPAIRS COULD RESULT IN FIRE, PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.

PERIODIC LUBRICATION SCHEDULE

*See Figure 10-2, Page 10-5.

PERIODIC LUBRICATION SCHEDULE

REGULAR INTERVAL	SERVICE	PLACE*	RECOMMENDED LUBRICANT
Semiannually by Owner or Trained Technician (Every 50 hours of operation or every 100 rounds for golf cars).	Brake pedal shaft bearings	1.	Dry Moly Lube - Club Car Part No. 1012151
	Brake Linkage and Pivots	2.	Dry Moly Lube - Club Car Part No. 1012151
	Accelerator push rod pivots, mounts, and shifter cable pivots	3.	Dry Moly Lube - Club Car Part No. 1012151
	Front Suspension (5 fittings)	4.	Chassis Lube - EP NLGI Grade 2
	Brake slides	5.	Dry Moly Lube - Club Car Part No. 1012151
Annually by Trained Technician Only (Every 100 hours of operation or every 200 rounds for golf cars).	Check/fill unitized transaxle to plug level	6.	27 oz. (.8 liter) 80-90 WT. API Class GL-3 or 80-90 WT. AGMA Class EP Gear Lube
	Inspect front wheel bearings. Repack as necessary.	7.	Chassis Lube - EP NLGI Grade 2
Periodic Lubrication Schedule continued on next page...			

PERIODIC LUBRICATION SCHEDULE

REGULAR INTERVAL	SERVICE	PLACE*	RECOMMENDED LUBRICANT
First Change 100 Hours. Additional Change every 200 Hours of Operation (or every 400 rounds for golf cars) or annually, which- ever comes first.	Change engine oil and oil filter	8.	32 oz. (.97 liter) without filter; 38 oz. (1.16 liters) with filter. 10W30 above 32°F (0°C) or SAE 5W20 below 32°F (0°C) API Class SE, SF, or SG Oil (or higher)

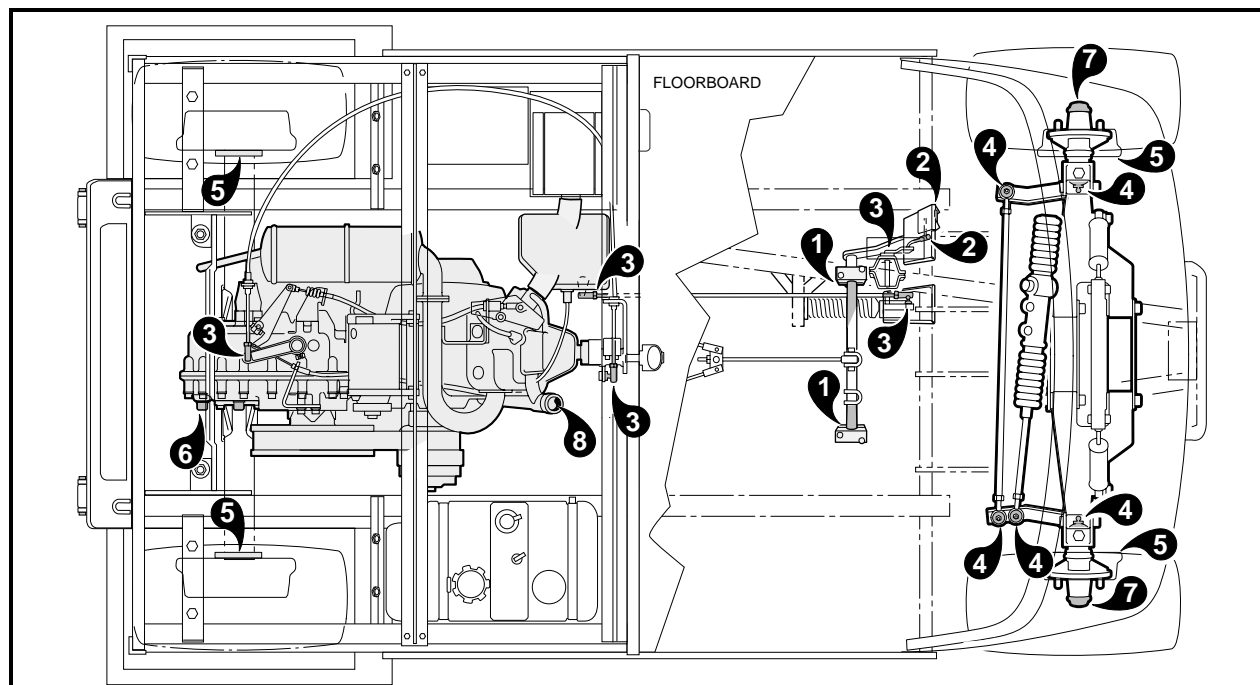


Figure 10-2 Lubrication Points

VEHICLE CAPACITIES**LIQUID CAPACITIES**

	GASOLINE VEHICLES
Engine Crankcase without filter	32 oz. (.95 liters)
Engine Crankcase with filter	38 oz. (1.12 liters)
Unitized Transaxle	27 oz. (.8 liters)
Gasoline Tank	7 gallons (26.5 liters)

TIRE CAPACITIES

	GASOLINE VEHICLES
DS Golf Car	12 - 14 psi (83-96 kPa)
Turf 1 and Carryall 1	14 - 16 psi (96-110 kPa)
Villager 4	12 - 14 psi (83-96 kPa)

ENGINE OIL

Read **DANGER** and **WARNING** on pages 10-1 and 10-2.

Even though the oil warning light on the dash should illuminate if the engine oil level is low, the engine oil level should be checked monthly. The vehicle should be on a level surface when checking oil.

⚠ CAUTION

- DO NOT REMOVE DIPSTICK WHILE ENGINE IS RUNNING.

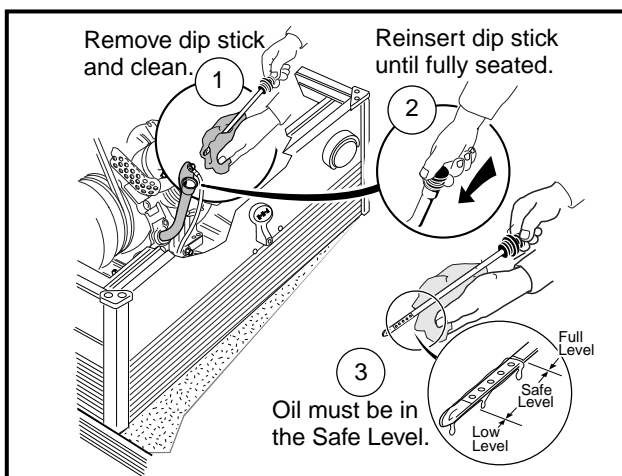


Figure 10-3 Checking Engine Oil

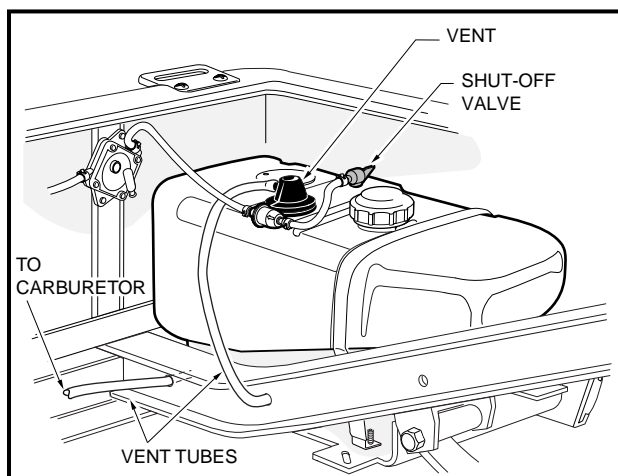


Figure 10-4 Gasoline Tank

OIL VISCOSITY

Choose the viscosity according to the temperature as shown (Figure 10-5, Page 10-6).

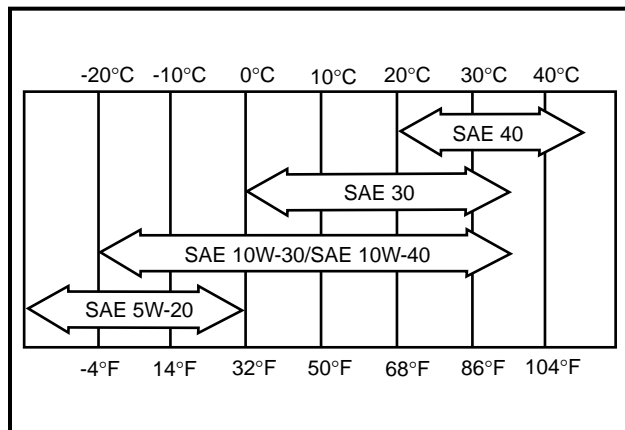


Figure 10-5 Oil Viscosity Chart

NOTE

- USING MULTI-GRADE OILS (5W-20, 10W-30, AND 10W-40) WILL INCREASE OIL CONSUMPTION. CHECK OIL LEVEL MORE FREQUENTLY WHEN USING MULTI-GRADE OILS.

FUELING INSTRUCTIONS

Read **DANGER** and **WARNING** on pages 10-1 and 10-2.

DANGER

- TURN KEY SWITCH TO OFF BEFORE REFUELING.
- NEVER POUR GASOLINE INTO THE FUEL TANK WHEN THE ENGINE IS HOT OR WHILE IT IS RUNNING.
- TO AVOID ELECTRIC ARC CAUSED BY STATIC ELECTRICITY, THE FUEL STORAGE/ PUMPING DEVICE MUST BE GROUNDED. IF THE PUMP IS NOT GROUNDED, THE VEHICLE MUST BE GROUNDED TO THE PUMP BEFORE AND DURING THE FUELING OPERATION.
- IF THE VEHICLE HAS AN ALL-WEATHER ENCLOSURE INSTALLED, THE GAS TANK MUST BE PROPERLY VENTED AS SHOWN (FIGURE 10-4, PAGE 10-6).
- TO AVOID THE POSSIBILITY OF FIRE, CLEAN UP ANY SPILLED GASOLINE BEFORE OPERATING THE VEHICLE.

CAUTION

- TO ALLOW FOR EXPANSION, DO NOT FILL HIGHER THAN ONE INCH FROM TOP OF THE FUEL TANK. AVOID SPILLING FUEL.

1. Lift and remove seat bottom.
2. The fuel tank is located on passenger side of vehicle. Remove fuel cap and fill the fuel tank with fresh unleaded gasoline only. **See following NOTE.**

NOTE

- WHENEVER POSSIBLE, AVOID USING OXYGENATED FUELS AND FUELS THAT ARE BLENDED WITH ALCOHOL. VEHICLES TO BE STORED FOR EXTENDED PERIODS SHOULD BE PREPARED FOR STORAGE AS INSTRUCTED IN SECTION 3 IN THE APPROPRIATE MAINTENANCE AND SERVICE MANUAL.

3. Replace the fuel cap on the tank. Make sure cap is tightened securely.
4. Replace seat bottoms.

BATTERY

For periodic battery maintenance, see **Battery, Section 12, Page 12-26.**

SECTION 11 – TROUBLESHOOTING AND ELECTRICAL SYSTEM

DANGER

- **BATTERY – EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM THE VEHICLE AND SERVICE AREA. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR A FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.**
- **BATTERY – POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:**
 - **EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.**
 - **INTERNAL: DRINK LARGE QUANTITIES OF WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.**
 - **EYES: FLUSH WITH WATER FOR 15 MINUTES. CALL A PHYSICIAN IMMEDIATELY.**
- **GASOLINE – FLAMMABLE! EXPLOSIVE! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM VEHICLE AND SERVICE AREA. SERVICE ONLY IN A WELL-VENTILATED AREA.**
- **DO NOT OPERATE VEHICLE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. THE ENGINE PRODUCES CARBON MONOXIDE, WHICH IS AN ODORLESS, DEADLY POISON.**

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THE VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW THE PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL **DANGER**, **WARNING**, AND **CAUTION** STATEMENTS LISTED IN THIS MANUAL AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY BEFORE SERVICING THE VEHICLE.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (–) FIRST.
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- **FRAME GROUND – DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRIC WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR ANY OTHER METAL COMPONENT.**
- FOR VEHICLES WITH CARGO BEDS, REMOVE ALL CARGO BEFORE RAISING THE BED. DO NOT CLOSE BED UNTIL ALL PERSONS ARE CLEAR OF CARGO BED AREA. KEEP HANDS CLEAR OF CRUSH AREA BETWEEN BED AND SEAT BACK SUPPORT. DO NOT DROP CARGO BED; LOWER GENTLY AND KEEP ENTIRE BODY CLEAR. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SEVERE PERSONAL INJURY.

WARNING CONTINUED ON NEXT PAGE...

⚠ WARNING

- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, SET THE PARK BRAKE WHEN LIFTING THE FRONT OF THE VEHICLE, UNLOAD THE CARGO BED AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. USE APPROVED JACK STANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.

GENERAL INFORMATION

Section 11 contains the information required to correctly troubleshoot the vehicle. A troubleshooting guide is provided for general troubleshooting. For issues pertaining solely to the electrical system, proceed to Circuit Testing on page 11-12.

In addition to troubleshooting, this section contains general information on the electrical system and the nine circuits of the electrical system.

TROUBLESHOOTING GUIDE

The following troubleshooting guide will be helpful in identifying operating difficulties should they occur. The guide includes the symptom, probable cause(s) and suggested checks. The procedures used in making these checks can be found in the referenced sections of the maintenance and service manual.

SYMPTOM	POSSIBLE CAUSES	REFER TO
Engine does not start easily.	1. Spark plug is partially fouled or in poor condition	Section 13 – Engine
	2. Spark plug wire is damaged or loose	Section 13 – Engine
	3. Loose wire connection at ignition coil or RPM limiter	Section 11 – Troubleshooting Test Procedures 13, 14 and 15,
	4. Intermittent ignition coil failure	Section 11 – Troubleshooting Test Procedures 13, 14 and 15
	5. Low cylinder compression	Section 13 – Engine
	6. Water or dirt in the fuel system and/or carburetor; dirty or clogged fuel filter	Section 14 – Fuel System
	7. Carburetor improperly adjusted	Section 14 – Fuel System
	8. Starter/generator belt is slipping	Section 12 – Electrical Components, Belt Tension Adjustment, page 12-12.
Engine starts but does not run smoothly.	1. Spark plug is fouled or in poor condition	Section 13 – Engine
	2. Spark plug wire is damaged or loose	Section 13 – Engine
	3. Intermittent ignition coil failure	Section 11 – Troubleshooting Test Procedures 13, 14 and 15
	4. Water or dirt in the fuel system and/or carburetor; dirty or clogged fuel filter	Section 14 – Fuel System
	5. Fuel pump malfunction; fuel pressure to engine too low	Section 14 – Fuel System
Troubleshooting Guide continued on next page. . .		

SYMPTOM	POSSIBLE CAUSES	REFER TO
Engine turns but fails to start.	1. Fuel tank is empty	Section 14 – Fuel System
	2. Fuel line or filters clogged	Section 14 – Fuel System
	3. Fouled spark plug	Section 13 – Engine
	4. Spark plug wire damaged or loose	Section 13 – Engine
	5. Loose wire connection at ignition coil or RPM limiter	Section 11 – Troubleshooting Test Procedures 13, 14 and 15
	6. Ignition coil failed	Section 11 – Troubleshooting Test Procedures 13, 14 and 15
	7. Engine flooded with fuel as result of excess choking	Section 3 – General Information Choke in the appropriate maintenance and service manual.
	8. Kill circuit grounded	Section 11 – Troubleshooting Test Procedures 16, 17 and 18
	9. Fuel pump malfunction or failure	Section 14 – Fuel System
Engine overheats.	1. Fan screen is partially blocked or plugged	Section 13 – Engine
	2. Governor is improperly adjusted	Section 14 – Fuel System
	3. Carburetor is too lean; check main jet size	Section 14 – Fuel System
Engine pre-ignites.	1. Excessive carbon deposits on piston head or in combustion chamber	Section 13 – Engine
	2. Spark plug heat range is incorrect for the engine	Section 13 – Engine
	3. Unsuitable or contaminated fuel	Section 14 – Fuel System
Loss of engine power.	1. Exhaust valve is restricted with carbon deposit	Section 13 – Engine
	2. Muffler or exhaust pipe restricted with carbon or other substance	Section 15 – Exhaust System
	3. Ignition coil failed	Section 11 – Troubleshooting Test Procedures 13, 14 and 15
	4. Air filter is dirty or clogged	Section 14 – Fuel System
	5. Governor is improperly adjusted	Section 14 – Fuel System
	6. Throttle linkage out of adjustment	Section 14 – Fuel System
	7. Low cylinder compression	Section 13 – Engine
	8. Spark plug failed	Section 13 – Engine
	9. Restricted fuel flow	Section 14 – Fuel System
	10. Torque converter is not backshifting properly	Section 17 – Torque Converter
Spark plug fouls repeatedly.	1. Incorrect plug	Section 13 – Engine
	2. Spark plug wire is damaged or loose	Section 13 – Engine
	3. Unsuitable fuel, or incorrect (rich) fuel mixture	Section 14 – Fuel System
	4. Ignition coil failed	Section 11 – Troubleshooting Test Procedures 13, 14 and 15
	5. Dirt entering combustion chamber	Check intake system for leaks – Section 14 – Fuel System
	6. Rings worn out, low cylinder pressure	Section 13 – Engine
Troubleshooting Guide continued on next page...		

SYMPTOM	POSSIBLE CAUSES	REFER TO
Carburetor floods.	1. Inlet valve or seat is leaking, dirty, worn, or damaged	Section 14 – Fuel System
	2. Float is damaged and filled with gasoline	Section 14 – Fuel System
	3. Float needle valve not functioning properly	Section 14 – Fuel System
	4. Carburetor vent is clogged	Section 14 – Fuel System
Starter fails to operate.	1. Neutral lockout cam is in the wrong position	Section 11 – Troubleshooting Neutral Lockout Circuit, Page 11-10.
	2. Fuse is blown	Section 11 – Troubleshooting Test Procedure 1
	3. Battery is dead	Section 11 – Troubleshooting Test Procedure 2
	4. Starter control circuit is not operating	Section 11 – Troubleshooting Starter Circuit, Page 11-12
	5. Starter/generator failed	Section 11 – Troubleshooting Test Procedure 8
	6. Starter solenoid failed	Section 11 – Troubleshooting Test Procedure 6
	7. Accelerator pedal limit switch failed	Section 11 – Troubleshooting Test Procedure 5
	8. Key switch failed	Section 11 – Troubleshooting Test Procedure 4
	9. Neutral lockout limit switch failed	Section 11 – Troubleshooting Test Procedure 7
	10. Loose or broken wire in starter/generator circuit	Section 12 – Electrical Components, Starter/Generator, page 12-2
	11. Cylinder and/or crankcase flooded with fuel	Section 14 – Fuel System
Starter/generator does not charge battery.	1. Loose or broken wire in the starter/generator circuit	Section 11 – Troubleshooting Test Procedure 10
	2. Generator field coil is shorted	Section 11 – Troubleshooting Test Procedure 10
	3. Brushes are worn or commutator is dirty	Section 12 – Electrical Components, Starter/Generator, Page 12-2.
	4. Starter/generator belt is loose or slipping	Section 12 – Electrical Components, Belt Tension Adjustment, Page 12-12
	5. Voltage regulator failed	Section 11 – Troubleshooting Test Procedure 2
	6. Battery failed	Section 11 – Troubleshooting Test Procedure 2
Transmission does not engage or disengage smoothly.	1. Transmission shifter linkage is binding or is out of adjustment	Section 16 – Unitized Transaxle
	2. Insufficient (low) level of lubricant, or wrong type of lubricant in transmission	Section 16 – Unitized Transaxle
	3. Internal gears are damaged or worn	Section 16 – Unitized Transaxle
	4. Synchronizer rings are worn, damaged or jammed	Section 16 – Unitized Transaxle
Troubleshooting Guide continued on next page...		

SYMPTOM	POSSIBLE CAUSES	REFER TO
Excessive vehicle vibration.	1. Engine mounting nuts or bolts are loose	Section 13 – Engine
	2. Rubber snubber on frame is worn or damaged	Section 13 – Engine
	3. Misaligned muffler mounting clamp	Section 15 – Exhaust System
	4. Damaged drive belt or starter belt	Section 17 – Torque Converter
	5. Damaged drive clutch	Section 17 – Torque Converter
	6. Damaged driven clutch	Section 17 – Torque Converter
	7. Damaged starter/generator pulley	Section 12 – Electrical Components, Starter/Generator, Page 12-2
	8. RPM setting is incorrect	Section 14 – Fuel System, see Engine RPM Adjustment, Page 14-14
Torque converter does not shift smoothly.	1. Drive belt is worn, cracked, glazed, or frayed	Section 17 – Torque Converter
	2. Drive clutch malfunction	Section 17 – Torque Converter
	3. Driven clutch malfunction	Section 17 – Torque Converter
	4. Governor is sticking	Section 16 – Unitized Transaxle
Engine won't stop running.	1. Kill circuit wire is disconnected from the ignition coil	Section 11 – Troubleshooting Test Procedure 12
	2. Accelerator pedal linkage out of adjustment, causing engine kill limit switch not to operate	Section 14 – Fuel System
	3. Carburetor is too lean; check main and pilot jet sizes	Section 14 – Fuel System
	4. Carburetor throttle stop screw misadjusted	Section 14 – Fuel System

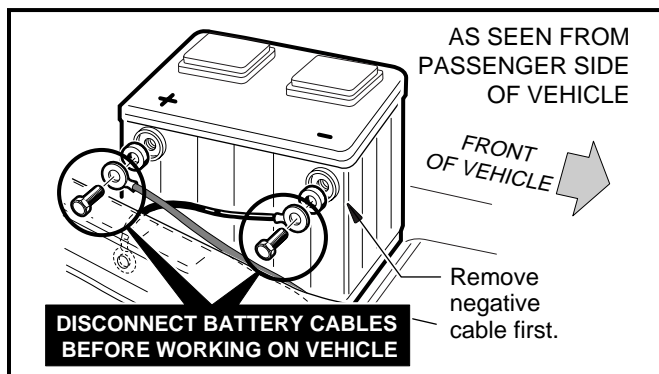


Figure 11-1 12-Volt Battery Disconnect

ELECTRICAL SYSTEM

The electrical system on the FE290 gasoline vehicle is 12-volts DC with negative ground to frame and consists of seven readily-identifiable circuits:

- Starter Circuit
- Generator Circuit
- Engine Ignition Circuit
- Engine Kill Circuit
- Reverse Buzzer Circuit
- Low Oil Warning Circuit
- Neutral Lockout Circuit

Utility vehicles (Turf 1, Carryall 1, and Villager 4) have two additional circuits:

- Fuel Gauge and Sending Unit Circuit
- Hour Gauge Circuit

Utility vehicles (Turf 1, Carryall 1, and Villager 4) have a combination fuel/hour gauge.

Recognizing and understanding the function of each of these circuits will help to quickly isolate the source of an electrical problem. Use the troubleshooting flow charts in the Circuit Testing section to find the proper test procedure to correct the electrical problem.

See Figure 11-2 for a complete wiring diagram.

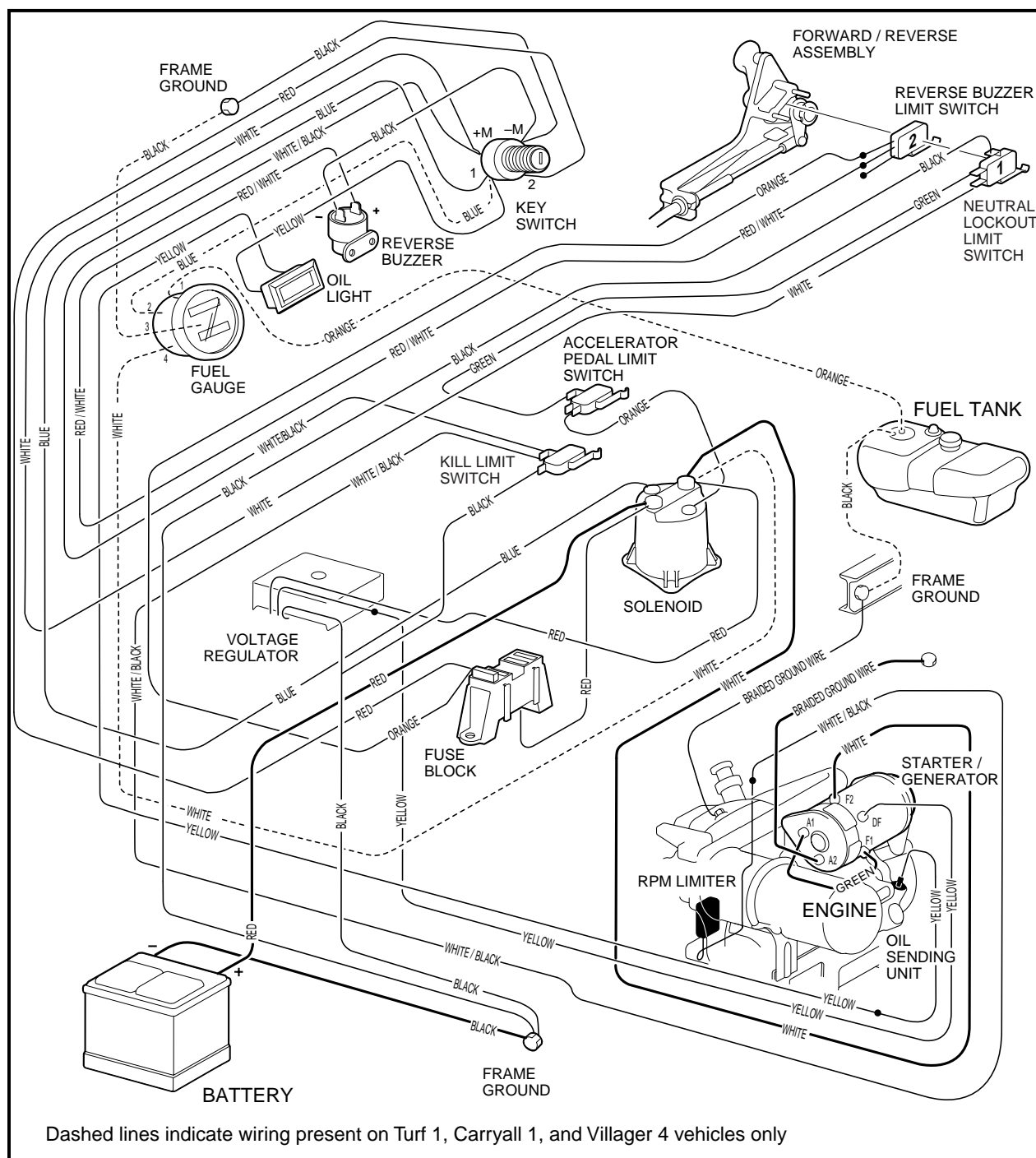


Figure 11-2 FE290 Gasoline Vehicle Wiring Diagram

ELECTRICAL CIRCUITS

STARTER CIRCUIT

The starter circuit consists of a 12-volt battery, fuse, key switch, accelerator pedal limit switch, neutral lockout limit switch, solenoid, starter/generator, and connecting wires (**Figure 11-3, Page 11-7**). The battery is the source of power for the system. The fuse provides protection to the solenoid activating circuit. **See following NOTE.**

NOTE

- THE STARTER CIRCUIT IS COMPLETELY INDEPENDENT OF THE IGNITION CIRCUIT. THE BATTERY DOES NOT SUPPLY POWER FOR IGNITION. THE BATTERY SUPPLIES POWER TO THE STARTER/GENERATOR WHICH IN TURN STARTS THE ENGINE COMPONENTS ROTATING. ONCE THE ENGINE IS RUNNING, THE IGNITION CIRCUIT SUPPLIES POWER TO THE SPARK PLUG. **SEE ENGINE IGNITION CIRCUIT, Page 11-8.**

The starter circuit is activated when the key switch is turned to the ON position, the accelerator pedal is depressed and the Forward/Reverse handle is placed in either the FORWARD or REVERSE position, thus actuating the neutral lockout limit switch. **See Neutral Lockout Circuit, Page 11-10.** Electrical current is then supplied to the solenoid, completing the circuit between the positive post of the battery and the F2 post of the starter/generator. The starter/generator then turns and cranks the engine through belt-driven pulleys.

NOTE

- ENGINE ROTATION (CLOCKWISE) IS AS VIEWED FROM THE CLUTCH ASIDE OF THE ENGINE.

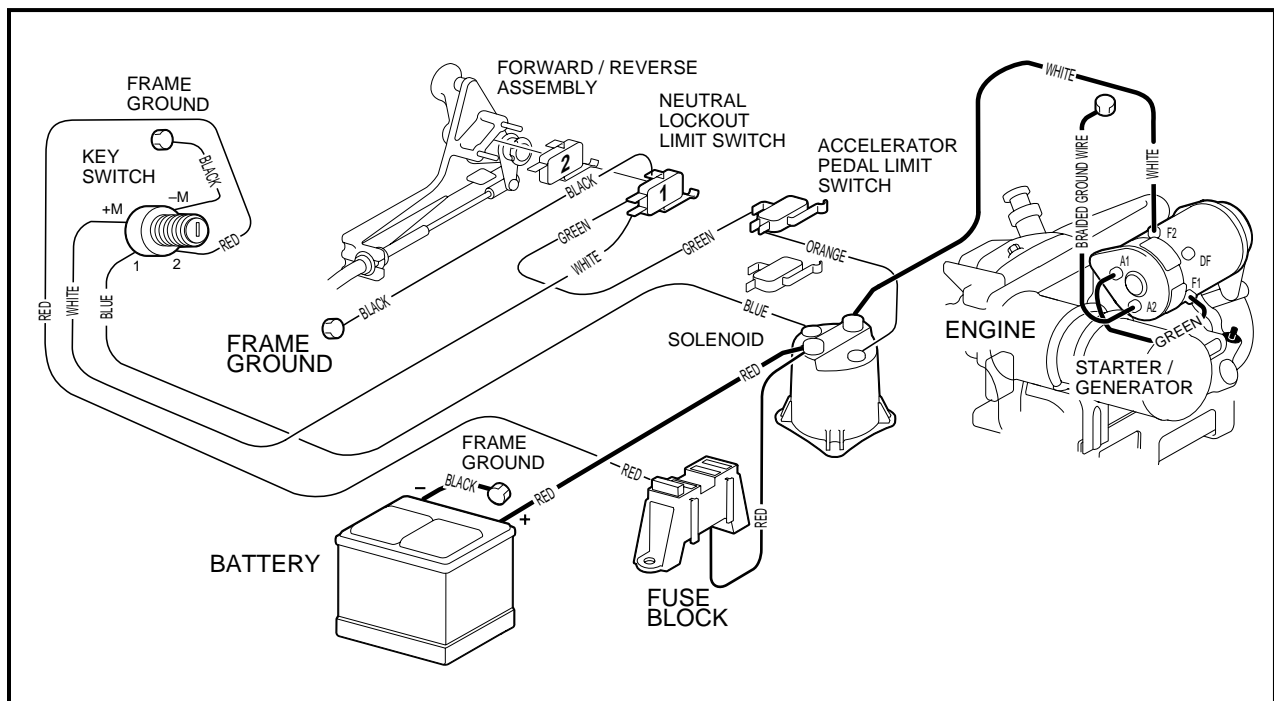


Figure 11-3 Starter Circuit

GENERATOR CIRCUIT

The generator circuit consists of the starter/generator, voltage regulator, solenoid, battery, and connecting wires (**Figure 11-4, Page 11-8**).

When battery power is first supplied to the starter/generator, the starter/generator turns the engine at low RPM (approx. 700). Once the engine starts running, it then drives the starter/generator. At any engine RPM over 1215 (3000 starter/generator RPM), the starter/generator functions as a generator, supplying charging current to the battery. To prevent battery overcharging, the voltage regulator senses battery voltage, and by opening and closing an electronic switch, controls the amount of charge going to the battery.

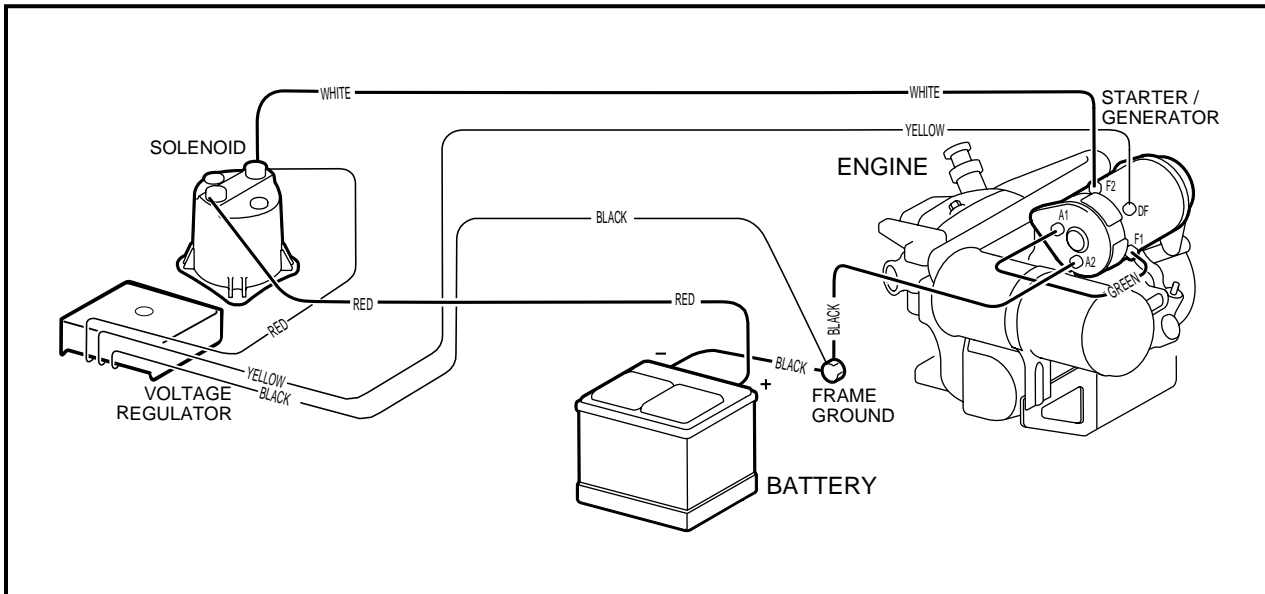


Figure 11-4 Generator Circuit

ENGINE IGNITION CIRCUIT

The engine ignition circuit is independent of all other circuits except the kill circuit. It consists of the ignition coil with internal igniter, spark plug, RPM limiter, and connecting wires (**Figure 11-5, Page 11-8**).

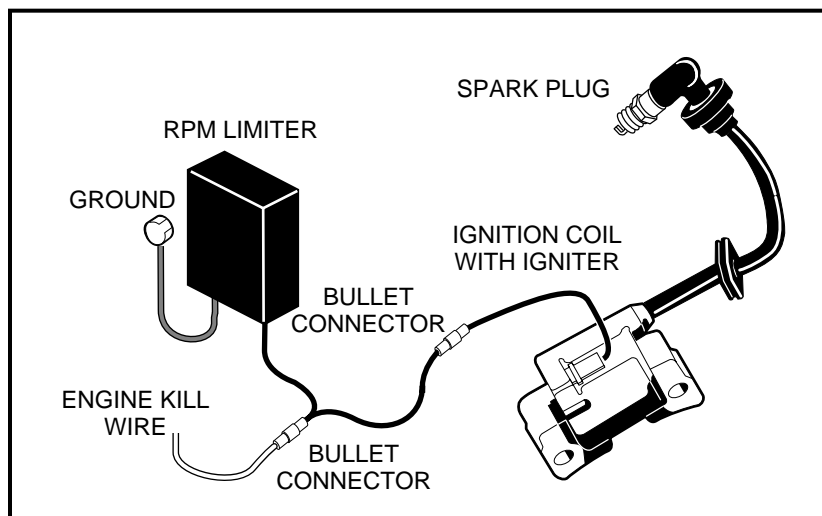


Figure 11-5 Engine Ignition Circuit

LOW OIL WARNING CIRCUIT

The low oil warning circuit consists of an oil level sensor in the engine, a dash-mounted low oil warning light, key switch, and connecting wires (**Figure 11-8, Page 11-9**).

The light receives power through the key switch when the key switch is turned to the ON position. When the oil level in the crankcase is low, the oil level sensor closes the circuit to the ground and illuminates the low oil warning light.

NEUTRAL LOCKOUT CIRCUIT

The neutral lockout circuit prevents the operator from starting the vehicle in NEUTRAL. Also, if the vehicle is started in FORWARD or REVERSE and then shifted to NEUTRAL, the engine will stop running.

The neutral lockout circuit consists of the connecting wires, a limit switch that is located on the Forward/Reverse shifter assembly, which is activated by a neutral lockout cam, and a limit switch that is located in the electrical component box, which is activated by the accelerator pedal (**Figure 11-9, Page 11-10**).

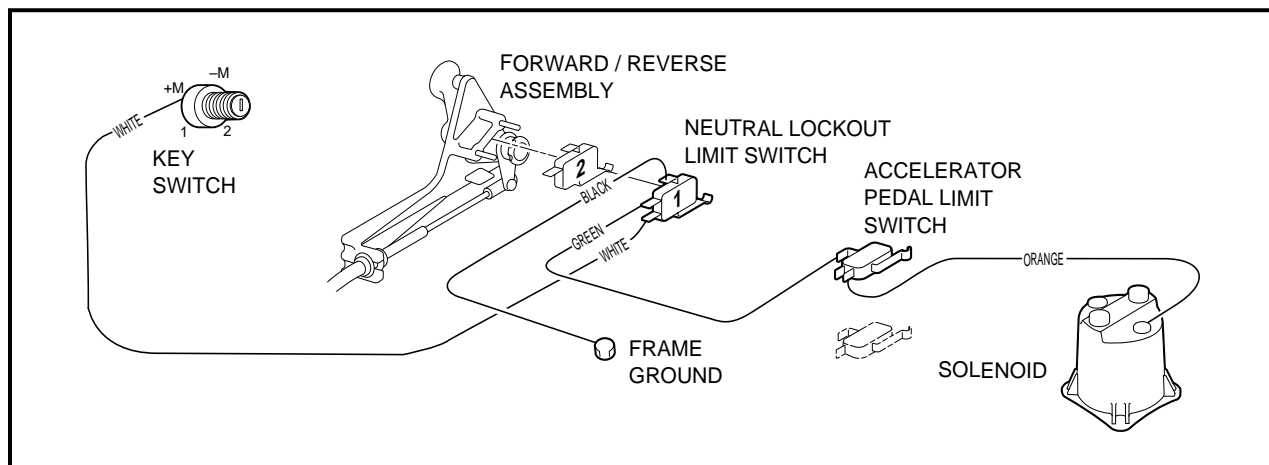


Figure 11-9 Neutral Lockout Circuit

For the convenience of the trained technician, there is a neutral lockout cam (yellow knob) located on the back of the Forward/Reverse shifter, inside the engine compartment. If the neutral lockout cam is pulled out approximately 3/8 inch (10 mm) and then rotated one-half turn until it snaps into place, the cam will be in the SERVICE position (**Figure 11-10, Page 11-11**).

When the cam is in the SERVICE position, it will allow the technician to run the engine in NEUTRAL for certain maintenance procedures. With the cam in this position, the vehicle will not operate if the Forward/Reverse handle is placed in either the FORWARD or REVERSE position.

To put the neutral lockout cam back into the OPERATE position, pull the cam out approximately 3/8 inch (10 mm) and rotate one-half turn until it snaps back into place (**Figure 11-11, Page 11-11**). **See following WARNING and NOTE.**

⚠ WARNING

- WITH THE CAM IN THE **SERVICE** POSITION AND THE ENGINE RUNNING, THE VEHICLE MAY MOVE SUDDENLY IF THE FORWARD/REVERSE HANDLE IS SHIFTED OR ACCIDENTALLY BUMPED. TO PREVENT THIS, CHOCK THE FRONT AND REAR WHEELS AND FIRMLY SET THE PARK BRAKE BEFORE SERVICING OR LEAVING THE VEHICLE.

NOTE

- BE SURE TO RETURN THE CAM TO THE **OPERATE** POSITION AFTER SERVICING THE VEHICLE, OR THE VEHICLE WILL NOT RUN.

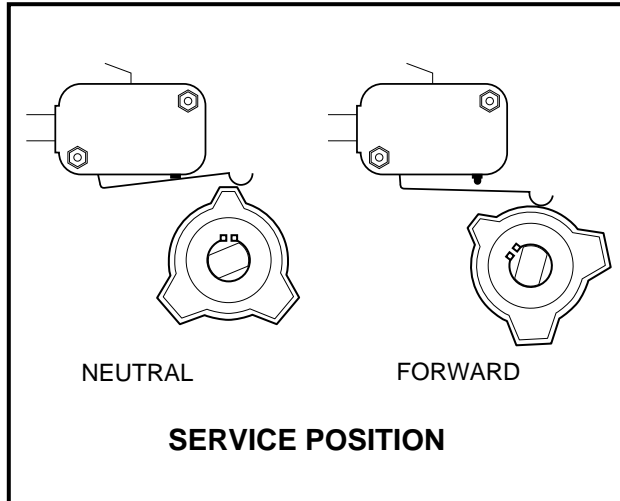
FUEL GAUGE AND SENDING UNIT CIRCUIT

Figure 11-10 Neutral Lockout Cam – Service

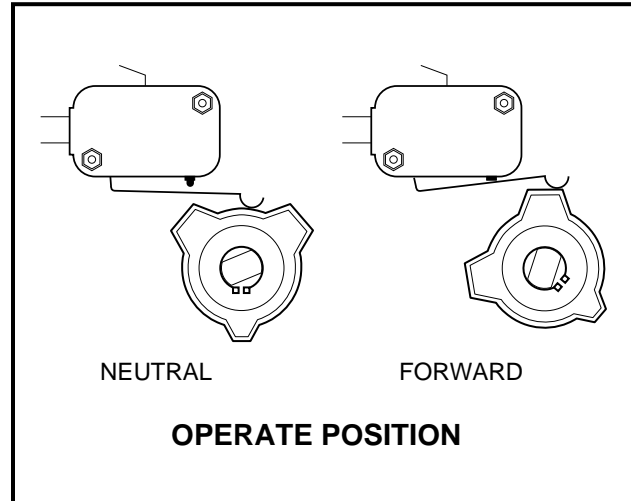


Figure 11-11 Neutral Lockout Cam – Operate

The fuel gauge and sending unit circuit consists of the fuel/hour gauge, fuel level sending unit, key switch, and connecting wires. The fuel gauge/sending unit picks up power from the key switch when the key switch is turned to the ON position. The power goes through the gauge to the fuel level sending unit at the fuel tank. The sending unit tells the gauge how much fuel is in the tank (**Figure 11-12, Page 11-11**).

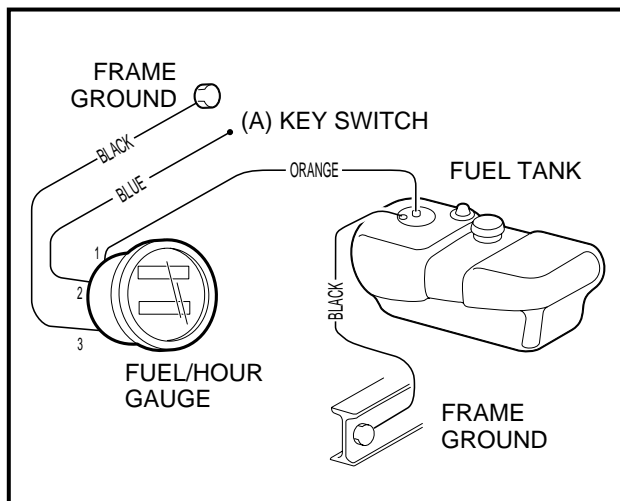


Figure 11-12 Fuel Gauge and Sending Unit Circuit

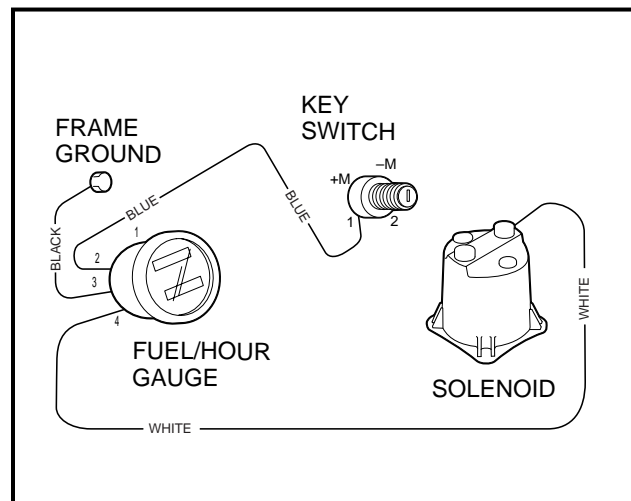


Figure 11-13 Hour Meter Circuit

HOUR GAUGE CIRCUIT

The hour gauge circuit consists of the fuel/hour gauge, key switch, solenoid, and connecting wires (**Figure 11-13, Page 11-11**).

CIRCUIT TESTING

Read DANGER and WARNING on page 11-1.

Before testing the electrical circuits to determine the source of an electrical problem, test the vehicle battery to determine whether or not it is the source of the problem. A hydrometer, multimeter, and 160-ampere load tester will be required. **See Test Procedure 2 – Battery, Page 11-19.**

TESTING THE STARTER CIRCUIT AND GENERATOR CIRCUIT

Read DANGER and WARNING on page 11-1.

Use the following chart (**Figure 11-14, Page 11-12**) to begin troubleshooting problems with the starter and generator circuits.

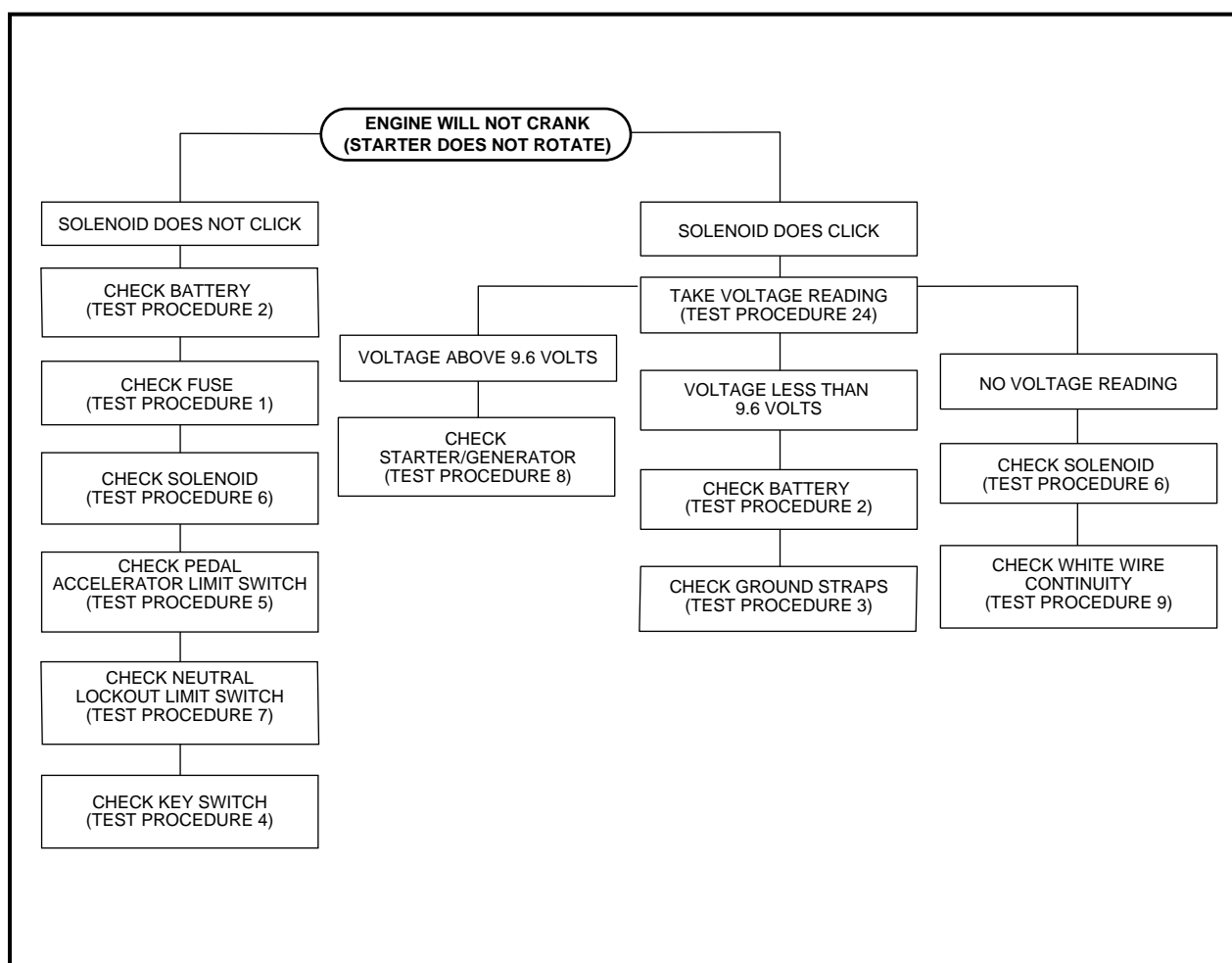


Figure 11-14 Testing the Starter and Generator Circuits

TESTING THE ENGINE IGNITION CIRCUIT

Read DANGER and WARNING on page 11-1.

Use the following chart (**Figure 11-15, Page 11-13**) to begin troubleshooting problems with the engine ignition circuit.

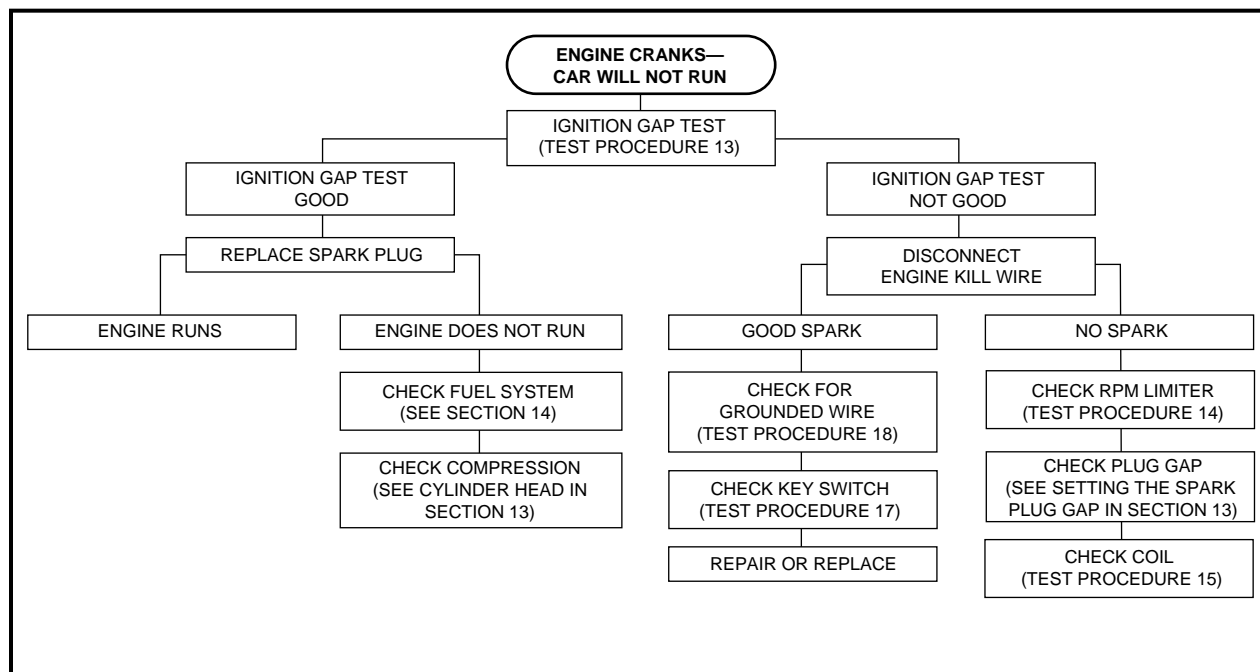


Figure 11-15 Testing the Engine Ignition Circuit

TESTING THE ENGINE KILL CIRCUIT

Read **DANGER** and **WARNING** on page 11-1.

Use the following charts (Figure 11-16, Page 11-13) through (Figure 11-18, Page 11-14) to begin troubleshooting problems with the engine kill circuit.

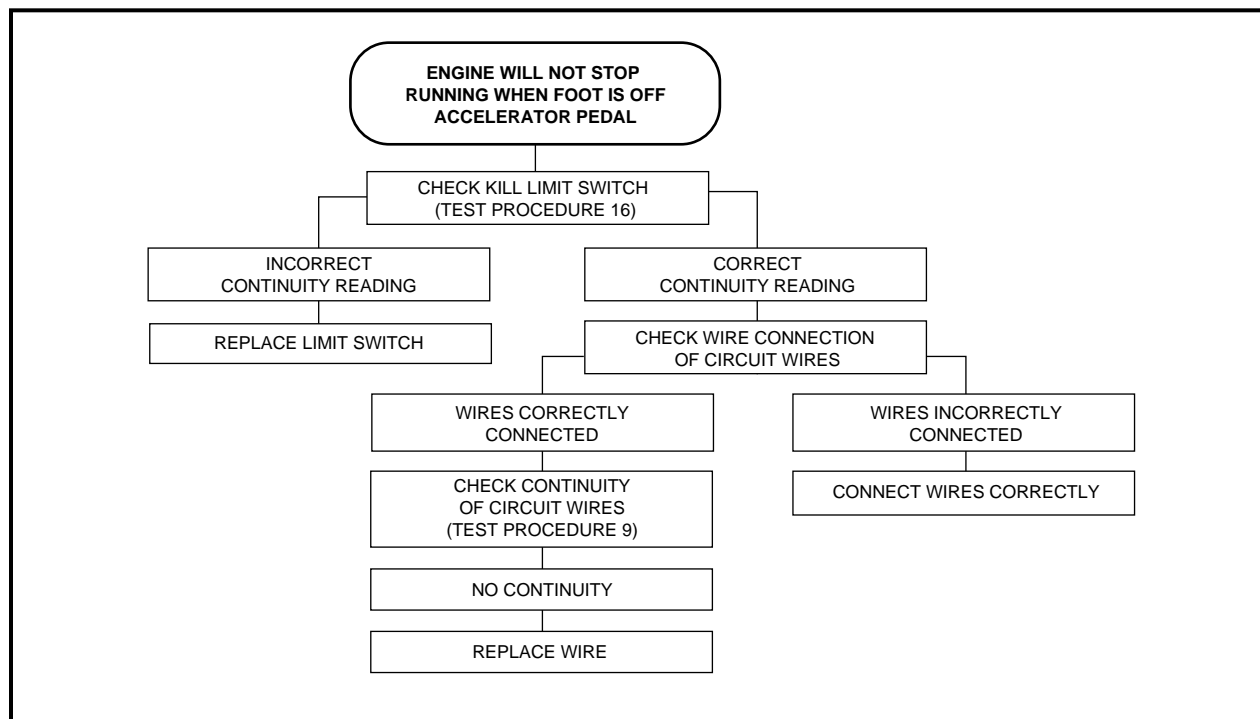


Figure 11-16 Testing the Engine Kill Circuit – Chart 1

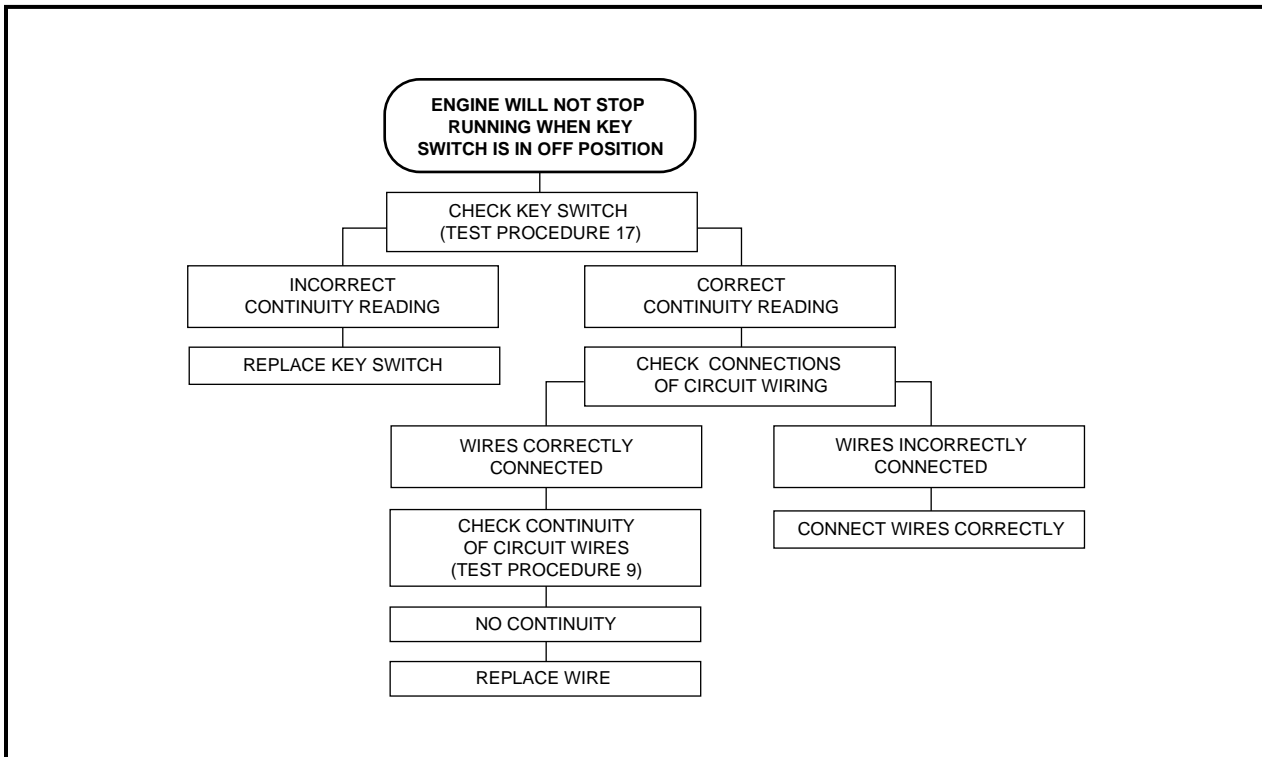


Figure 11-17 Testing the Engine Kill Circuit – Chart 2

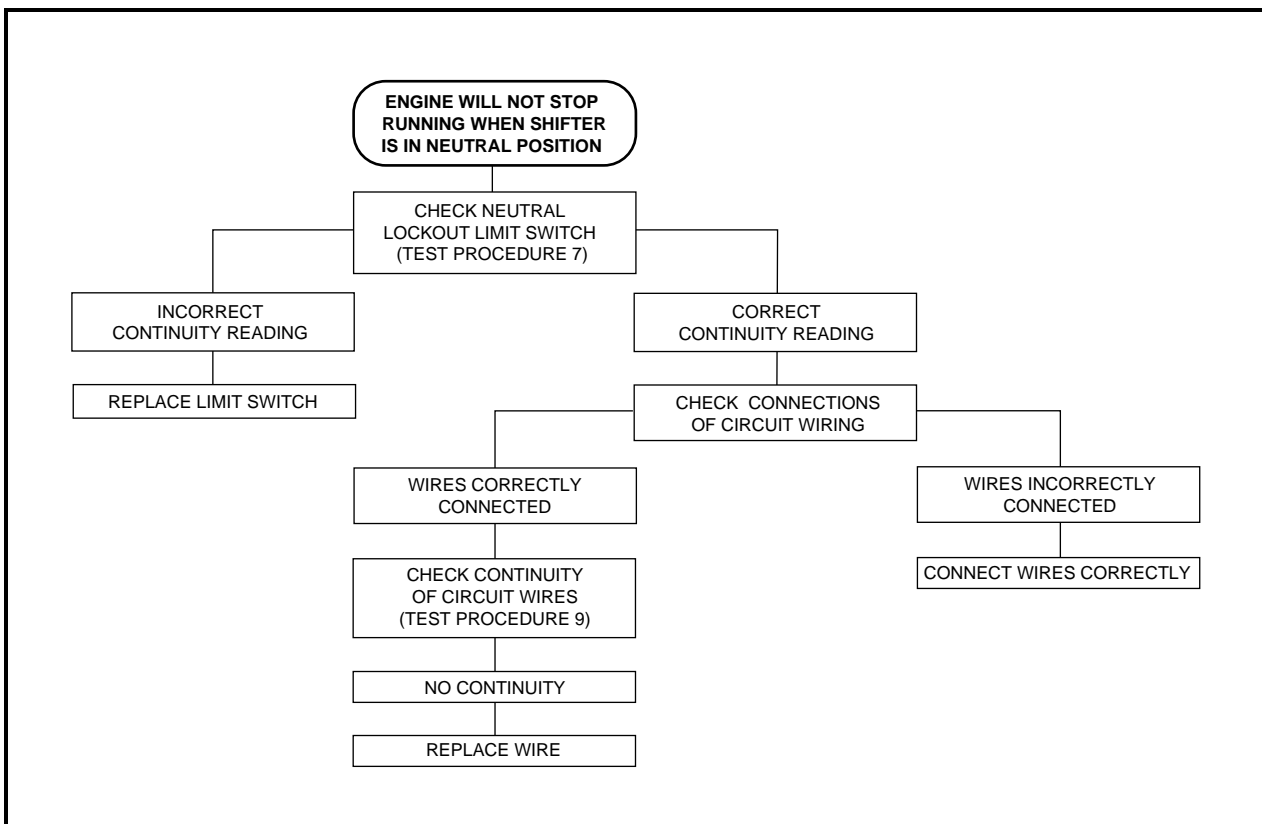


Figure 11-18 Testing the Engine Kill Circuit – Chart 3

TESTING THE REVERSE BUZZER CIRCUIT

Read **DANGER** and **WARNING** on page 11-1.

Use the following chart (**Figure 11-19**) to begin troubleshooting the reverse buzzer circuit.

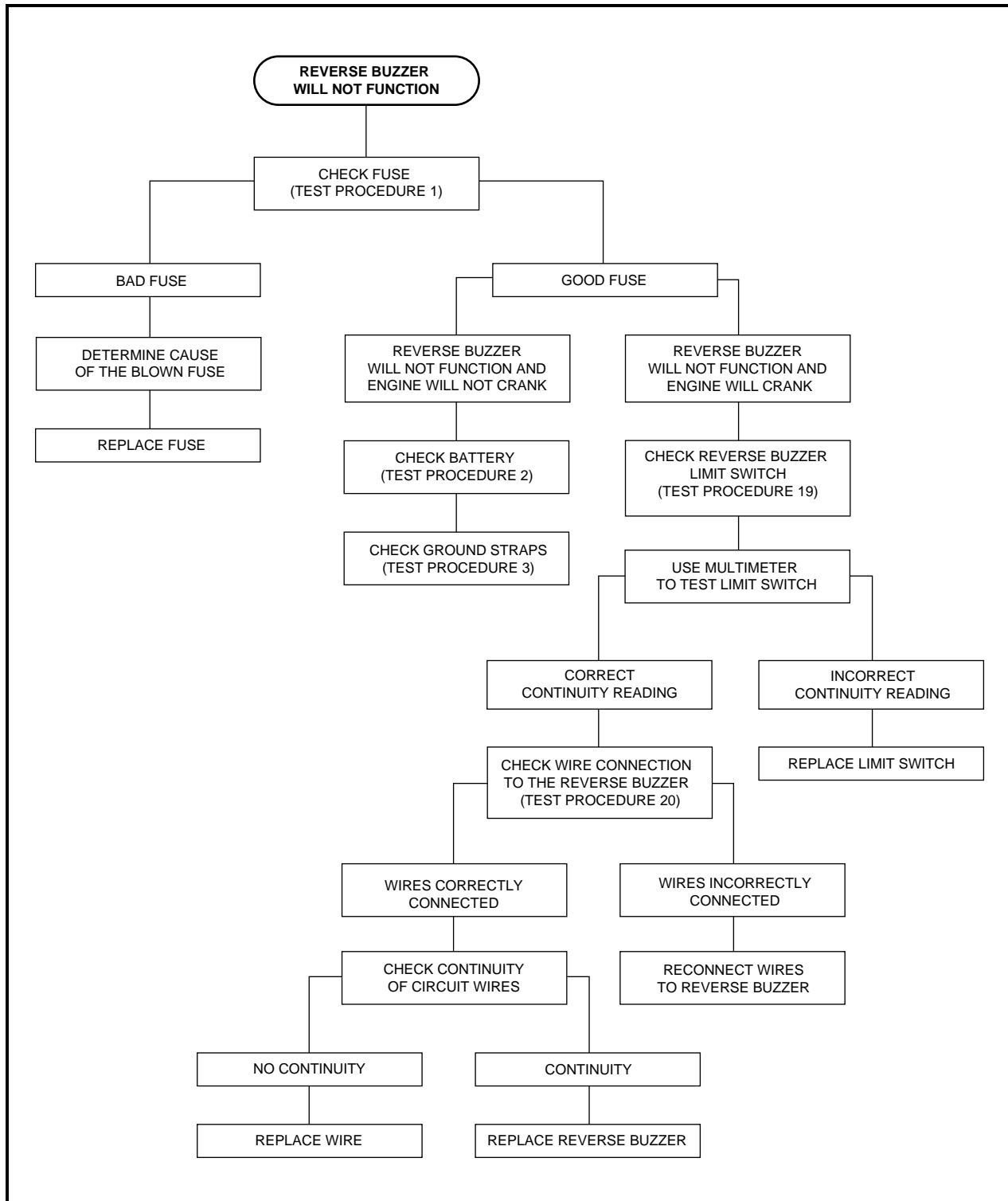


Figure 11-19 Testing the Reverse Buzzer Circuit

TESTING THE LOW OIL WARNING CIRCUIT

Read **DANGER** and **WARNING** on page 11-1.

Use the chart below (**Figure 11-20**) to begin troubleshooting the low oil warning circuit.

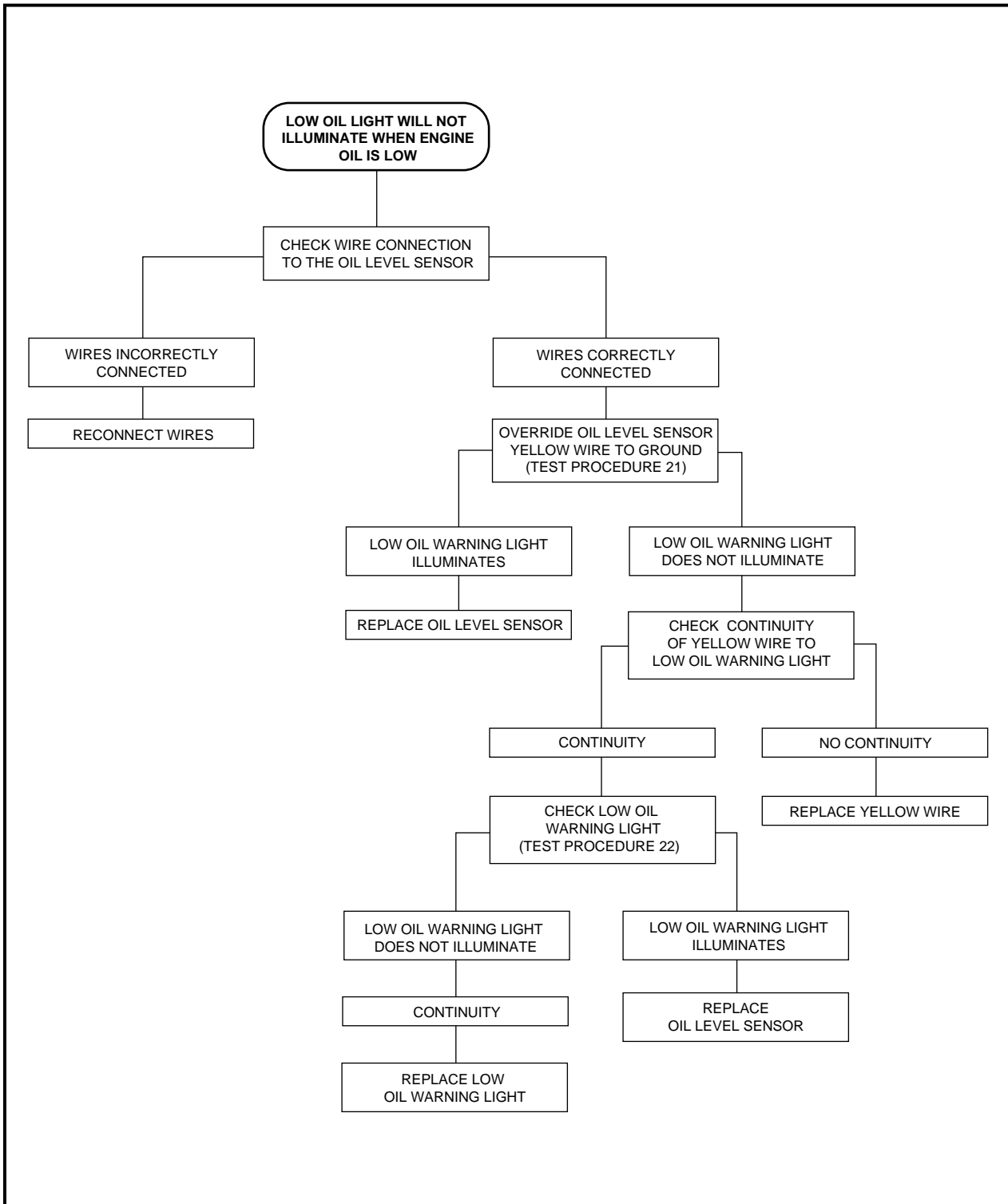


Figure 11-20 Testing the Low Oil Warning Circuit

TESTING THE NEUTRAL LOCKOUT CIRCUIT

Read **DANGER** and **WARNING** on page 11-1.

Use the chart below (Figure 11-21) to begin troubleshooting the neutral lockout circuit.

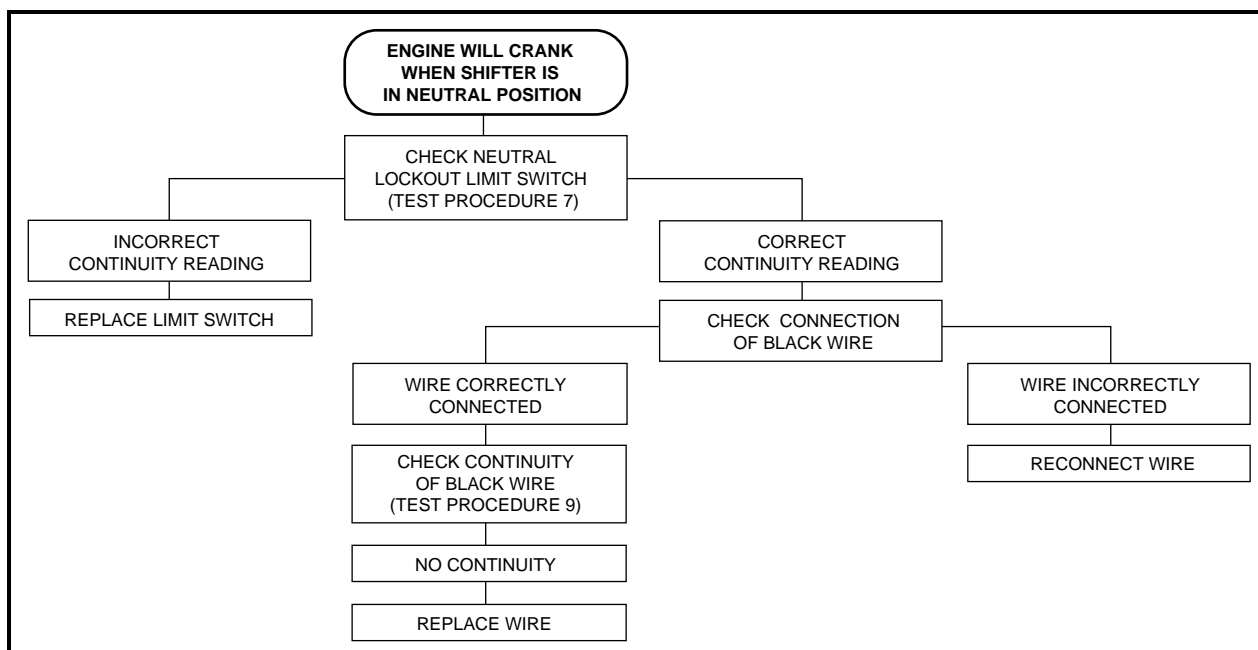


Figure 11-21 Testing the Neutral Lockout Circuit

TESTING THE FUEL GAUGE AND SENDING UNIT CIRCUIT

Read **DANGER** and **WARNING** on page 11-1.

Use the chart below (Figure 11-22) to begin troubleshooting fuel gauge and sending unit circuit.

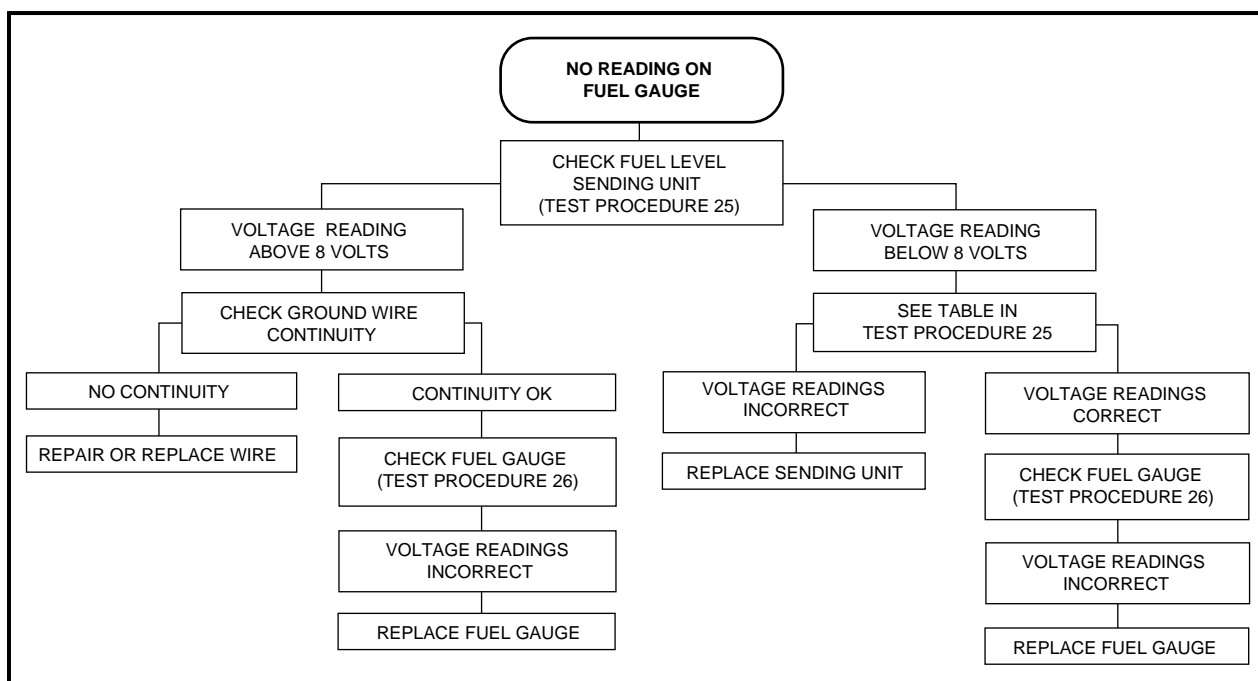


Figure 11-22 Testing the Fuel Gauge and Sending Unit Circuit

TEST PROCEDURES

INDEX OF TEST PROCEDURES

1. Fuse
2. Battery
3. Ground Straps
4. Key Switch (Starter Circuit)
5. Accelerator Pedal Limit Switch
6. Solenoid
7. Neutral Lockout Limit Switch
8. Starter/Generator (Starter Function)
9. Wire Continuity
10. Starter/Generator (Generator Function)
11. Voltage Regulator
12. Disconnected Kill Wire
13. Ignition Spark
14. RPM Limiter
15. Ignition Coil
16. Kill Limit Switch
17. Key Switch (Engine Kill Circuit)
18. Engine Kill Wire
19. Reverse Buzzer Limit Switch
20. Reverse Buzzer
21. Oil Level Sensor
22. Oil Warning Light
23. Neutral Lockout Cam
24. Battery Test (Under Load)
25. Fuel Level Sending Unit
26. Fuel Gauge
27. Hour Meter

TEST PROCEDURE 1 – FUSE

Read DANGER and WARNING on page 11-1.

The fuse (red 10 amp) is located in the electrical component box.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in the NEUTRAL position, chock the wheels, and disconnect the battery (negative cable first).
2. Remove the cover on the electrical component box.
3. Check that the wires are connected correctly and are tight. If they are not, rewire or tighten as necessary.
4. Remove the fuse to be tested from the fuse block. **See Fuse Removal, Section 12 – Electrical Components, Page 12-15.**
5. Using a multimeter set on 200 Ω (ohms), place the red (+) probe on one fuse terminal and the black (–) probe on the other fuse terminal. The reading should be continuity. If the reading is incorrect, determine and repair the cause of the fuse failure. Replace the fuse with a properly rated new one.

TEST PROCEDURE 2 – BATTERY

Read **DANGER** and **WARNING** on page 11-1.

DANGER

- **DUE TO THE DANGER OF AN EXPLODING BATTERY, WEAR A FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING AROUND A BATTERY.**
- **BATTERY – EXPLOSIVE GASES! KEEP SPARKS AND FLAMES AWAY FROM VEHICLE AND SERVICE AREA. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR EYE PROTECTION WHEN WORKING ON OR NEAR BATTERY. FOR ADDED PROTECTION, COVER TOP OF THE BATTERY WHEN SERVICING THE VEHICLE.**
- **BATTERY – POISON! CONTAINS ACID! CAUSES SEVERE BURNS! AVOID CONTACT WITH SKIN, EYES, OR CLOTHING.**
 - **EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.**
 - **INTERNAL: DRINK LARGE QUANTITIES OF WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.**
 - **EYES: FLUSH WITH WATER FOR 15 MINUTES. CALL A PHYSICIAN IMMEDIATELY.**

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in the NEUTRAL position, and chock the wheels.
2. Check for loose or corroded battery terminal connections. Clean, tighten, and replace connections as necessary.

Hydrometer Test

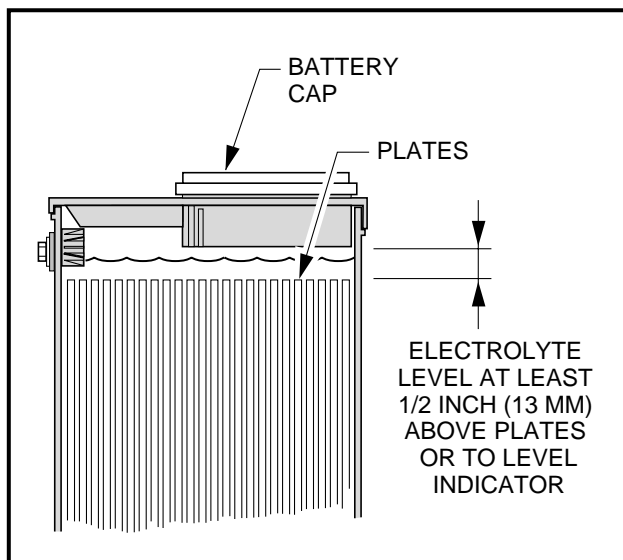
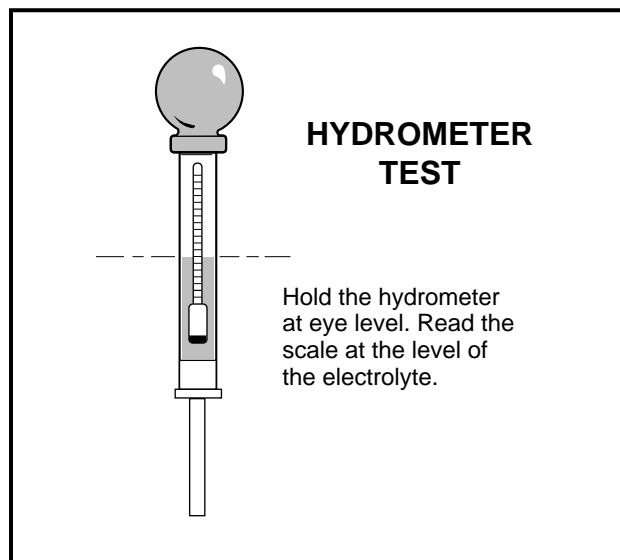
A hydrometer measures the specific gravity. The higher the specific gravity, the higher the state of charge of the battery. A fully charged battery should read between 1.250 and 1.280 at 80 °F (27 °C). Never add acid to the battery to obtain a higher specific gravity.

Performing the Hydrometer Test

CAUTION

- **DO NOT ALLOW BATTERY ACID FROM BATTERY CAPS OR HYDROMETER TO DRIP ONTO THE BODY. BATTERY ACID WILL CAUSE PERMANENT DAMAGE. WASH OFF IMMEDIATELY.**

1. Be sure that the battery has sufficient water to cover the plates by approximately 1/2 inch (12.7 mm) and is fully charged prior to beginning the test. If water must be added, recharge the battery before performing the hydrometer test (**Figure 11-23, Page 11-20**).
2. Remove the vent cap.
3. Using a battery thermometer (Club Car Part No. 1011767), record the electrolyte temperature of a center cell.
4. Squeeze the rubber bulb of the hydrometer and insert into the cell. Slowly release the bulb, drawing electrolyte up into the glass tube of the hydrometer.
5. When the float rises off the bottom, adjust the electrolyte level so that the float rides free of the bottom but does not strike the bottom of the rubber bulb. Remove the hydrometer from the cell and release the pressure from the bulb.
6. Hold the hydrometer vertically, ensuring that the float is not contacting the sides of the glass tube. Hold the hydrometer at eye level and read the scale at the level of electrolyte (**Figure 11-24, Page 11-20**).

Test Procedure 2, Continued:**Figure 11-23 Battery Electrolyte Level****Figure 11-24 Reading Hydrometer**

7. Record the reading.
8. Return the electrolyte to the cell from which it was taken. Replace vent cap.
9. Repeat steps 2-8 on all cells.

Hydrometer Calibration

Most hydrometers are calibrated to read correctly at 80 °F (27 °C). The readings obtained as described above must be corrected for temperature. For each 10 °F (5.6 °C) above 80 °F (27 °C), add 0.004 to the reading. For each 10 °F (5.6 °C) below 80°F (27 °C), subtract 0.004 from the reading.

Interpreting the Results of the Hydrometer Test

The approximate state of charge can be determined from the following table:

SPECIFIC GRAVITY AT 80 °F (27 °C)	STATE OF CHARGE
1.250 - 1.280	100%
1.220 - 1.240	75%
1.190 - 1.210	50%
1.160 - 1.180	25%

If the difference between the cells is 0.020 or more, the low cell should be suspected. It may require a catch-up charge or it may be a weak cell. When the variations between cells reach 0.050 or more, the battery should be replaced.

Voltage Test

1. Place the red (+) probe of a multimeter, set at volts DC, 20-volt range, on the positive (+) post and place the black (–) probe on the negative (–) post of the battery and take a voltage reading. If it shows less than 12.4 volts, or if the lowest specific gravity reading from the hydrometer test is less than 1.225, recharge the battery. If battery voltage is greater than 12.4 volts and specific gravity is greater than 1.225, the problem is not with the battery. If the battery does not reach 12.4 volts, or if the specific gravity of a cell is still less than 1.225 after charging, replace the battery. **See following NOTE.**

NOTE

- A FULLY CHARGED BATTERY THAT IS IN GOOD CONDITION SHOULD HAVE A SPECIFIC GRAVITY OF AT LEAST 1.225 IN ALL CELLS, AND THE DIFFERENCE IN THE SPECIFIC GRAVITY OF ANY TWO CELLS SHOULD BE **LESS** THAN 50 POINTS. OPEN CIRCUIT VOLTAGE SHOULD BE AT LEAST 12.4 VOLTS.

Load Test

1. Using a 160-ampere load tester, connect the load tester to the battery posts.
2. Turn the switch on the load tester to the ON position.
3. Read the battery voltage after the load tester has been turned on for 15 seconds. Compare the battery voltage reading with the table below. Make sure you have the correct ambient temperature.

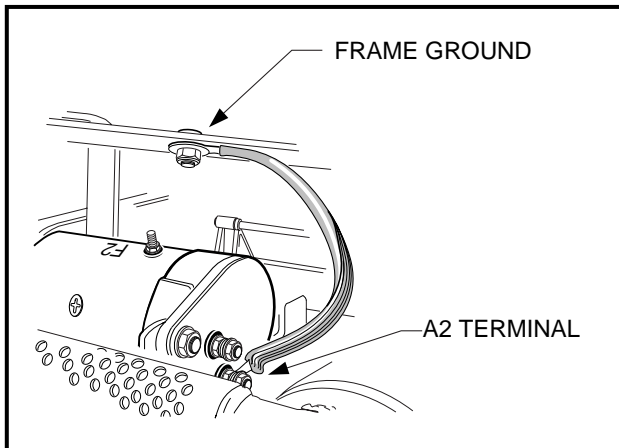
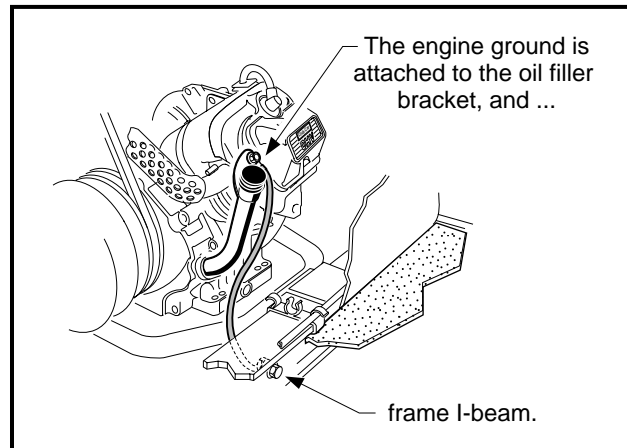
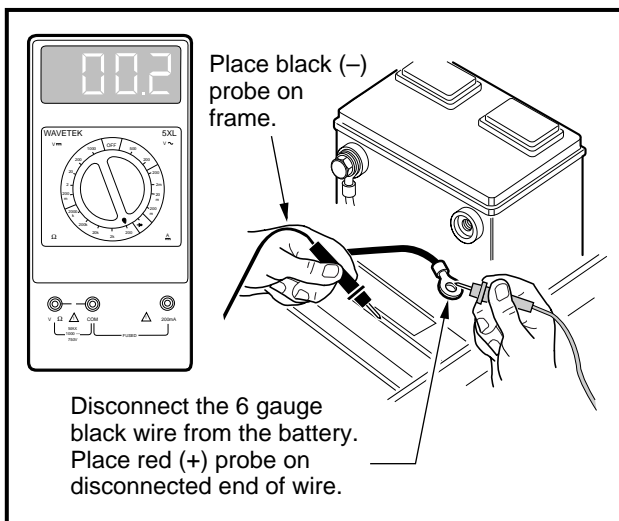
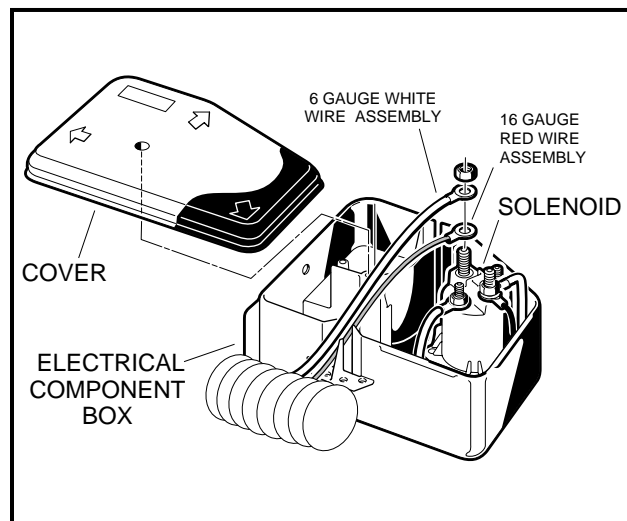
If Temperature is	Minimum Voltage Required is
70 °F (20 °C and above)	9.6 V
60 °F (16 °C)	9.5 V
50 °F (10 °C)	9.4 V
40 °F (4 °C)	9.3 V
30 °F (-1 °C)	9.1 V
20 °F (-7 °C)	8.9 V
10 °F (-12 °C)	8.7 V
0 °F (-18 °C)	8.5 V

4. If the battery is found to be good, or if the electrical problem continues after the battery has been replaced with a good one, test the electrical circuits.

TEST PROCEDURE 3 – GROUND STRAPS

Read **DANGER** and **WARNING** on page 11-1.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. Check the starter/generator ground strap.
 - 2.1. Set the multimeter to 200 Ω (ohms). Place the red (+) probe on the A2 terminal of the starter/generator and place the black (–) probe on the vehicle frame (**Figure 11-25, Page 11-22**). The reading should be continuity. If the reading is incorrect, clean and tighten wire connections. If the connections are good, repair or replace the wire.

Test Procedure 3, Continued:**Figure 11-25 Test Starter/Generator Ground Strap****Figure 11-26 Test Engine Ground Strap****Figure 11-27 Test Battery Ground Strap****Figure 11-28 Solenoid Wire Connections**

3. Check the engine ground strap.
 - 3.1. Place the red (+) probe of the multimeter on the ground strap terminal end located on the oil filler tube bracket on the engine (**Figure 11-26, Page 11-22**). Place the black (-) probe on the vehicle frame. The reading should be continuity. If the reading is incorrect, clean and tighten wire connections. If the connections are good and the reading is incorrect, repair or replace the wire.
4. Check the battery ground cable.
 - 4.1. A 6 gauge black wire connects the negative battery post to the frame. The frame connection should be clean and tight. Visual inspection of the connection on the frame is very difficult. The best check for tightness is to pull on the black wire. If the wire moves at the connection end, disassemble the frame connection and clean the bolt, ring terminal, and nut. Reinstall the frame connection.
 - 4.2. Set the multimeter to 200 Ω (ohms). Place the red (+) probe on the unconnected end of the 6 gauge black wire, and place the black (-) probe on the vehicle frame (**Figure 11-27, Page 11-22**). The reading should be continuity. If the reading is incorrect, check that terminal connections are clean and tight. If the connections are good and the reading is incorrect, repair or replace the wire.

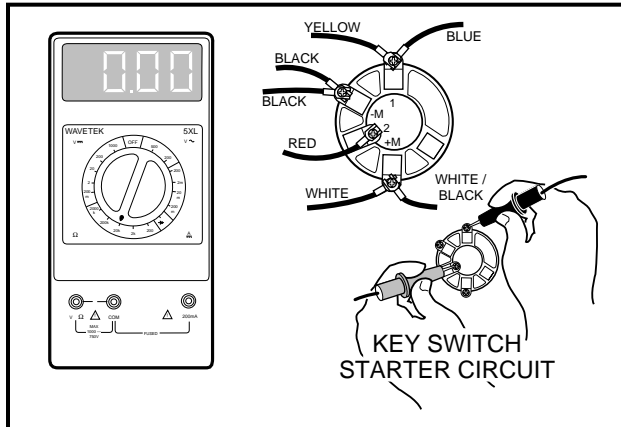


Figure 11-29 Test Key Switch – Engine Starter Circuit

TEST PROCEDURE 4 – KEY SWITCH (STARTER CIRCUIT)

Read **DANGER** and **WARNING** on page 11-1.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. Remove the center dash assembly. **See Key Switch Removal, Section 12 – Electrical Components, Page 12-13.**
3. Ensure that the wires are connected correctly and are tight. If they are not, rewire or tighten as necessary.
4. Insert the key and turn the switch to ON. Place the red (+) probe of the multimeter on the No. 2 terminal and the black (–) probe on the No. 1 terminal of the key switch. The reading should be continuity. If the reading is incorrect, replace the key switch (**Figure 11-29, Page 11-23**).

TEST PROCEDURE 5 – ACCELERATOR PEDAL LIMIT SWITCH

Read **DANGER** and **WARNING** on page 11-1.

The accelerator pedal limit switch is the top switch located in the electrical component box. There is an 18 gauge green wire and an 18 gauge orange wire connected to this limit switch.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. Check for proper wiring and tight connections (**Figure 11-3, Page 11-7**).
3. Set the multimeter to 200 Ω (ohms). Place the red (+) probe on the common (COM) terminal (green wire) of the limit switch and place the black (–) probe on the normally closed (NC) terminal (orange wire) of the limit switch.
4. Make sure the battery is disconnected. With the key switch in the OFF position, the Forward/Reverse handle in NEUTRAL, and the accelerator pedal in the UP position, the reading should be **NO** continuity. With the accelerator pedal depressed, the reading should be continuity. If readings are incorrect, replace the switch.

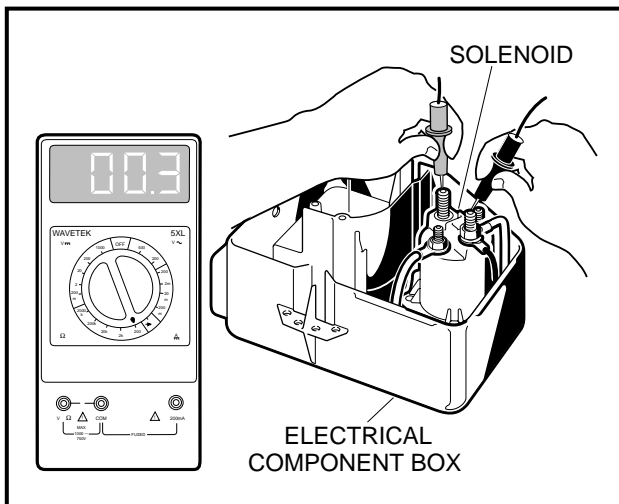
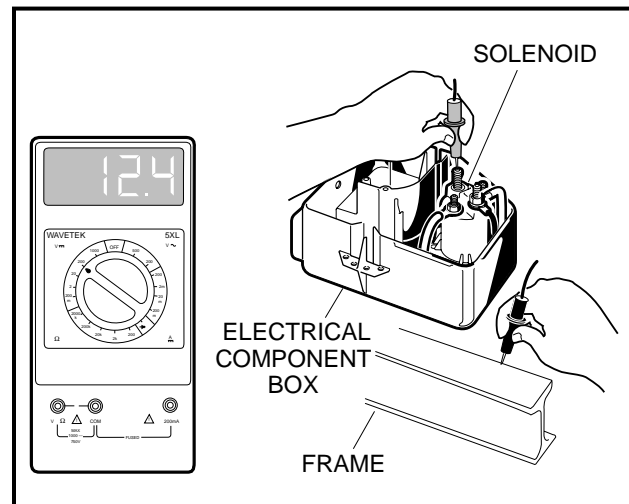
TEST PROCEDURE 6 – SOLENOID

Read **DANGER** and **WARNING** on page 11-1.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.

Test Procedure 6, Continued:

2. Remove the electrical component box cover.
3. Check that the wires are connected correctly and are tight. If they are not, rewire or tighten as necessary.
4. Set a multimeter to 200 Ω (ohms). Place the red (+) probe on one of the small posts of the solenoid and place the black (–) probe on the other small post. The reading should be 14 to 16 Ω (ohms). If the reading is not within limits, replace the solenoid.
5. Making sure the battery is disconnected, remove the 6 gauge white wire and the 16 gauge red wire from the large post of the solenoid. Do not allow the wires to touch the frame or other components of the vehicle (**Figure 11-28, Page 11-22**).
6. Set the multimeter to 200 Ω (ohms). Connect the red (+) probe to one of the large posts of the solenoid and connect the black (–) probe to the other large post (**Figure 11-30, Page 11-24**).
7. Connect the battery, positive cable first.
8. Place the Forward/Reverse handle in NEUTRAL, and place the neutral lockout cam in the SERVICE position. Turn the key switch to the ON position. With the accelerator in the UP position, the reading on the multimeter should be **NO** continuity. Depress the accelerator pedal and listen for the solenoid click. There should be continuity. If either reading is incorrect, replace the solenoid.
9. With the Forward/Reverse handle still in NEUTRAL and the neutral lockout cam in the SERVICE position, set the multimeter to volts DC (DC V) and place the red (+) probe on the large post that does *not* have wires connected to it. Place the black (–) probe on the frame of the vehicle. Turn key switch to the ON position, depress accelerator pedal, and listen for solenoid click. The meter should read full battery voltage. If the reading is incorrect, replace the solenoid (**Figure 11-31, Page 11-24**).
10. Disconnect the 6 gauge black wire from the negative post of the battery before reconnecting the wires to the solenoid.

**Figure 11-30 Test Solenoid Continuity****Figure 11-31 Test Solenoid Ground****TEST PROCEDURE 7 – NEUTRAL LOCKOUT LIMIT SWITCH**

Read DANGER and WARNING on page 11-1.

This switch is located on the Forward/Reverse shifter assembly. There is a black wire, a green wire, and a white wire connected to this limit switch.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. Check for proper wiring and tight connections.
3. Set a multimeter to 200 Ω (ohms). Place the red (+) probe of the multimeter on the common (COM) terminal of the limit switch. Place the black (–) probe on the normally open (NO) terminal of the limit switch. Without the lever depressed, the reading should be **NO** continuity. With the lever depressed, the reading should be continuity. If either reading is incorrect, replace the limit switch (**Figure 11-32, Page 11-25**).

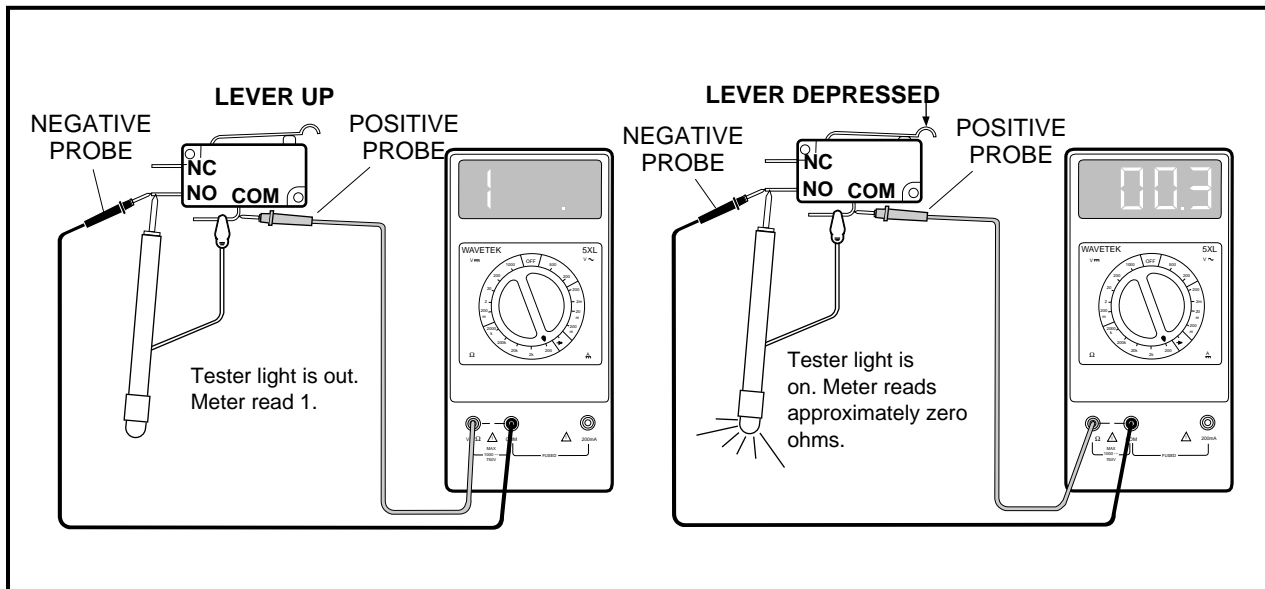


Figure 11-32 Test Neutral Lockout Switch

4. Check to be sure the lobes on the cam are depressing the neutral lockout limit switch as the Forward/Reverse handle is being shifted. The limit switch should make an audible click as it is depressed. If it does not, check for wear on the cam lobes. Be sure the cam snaps fully back into place. If the cam lobes still do not activate the limit switch, replace the cam.

TEST PROCEDURE 8 – STARTER/GENERATOR (STARTER FUNCTION)

Read **DANGER** and **WARNING** on page 11-1.

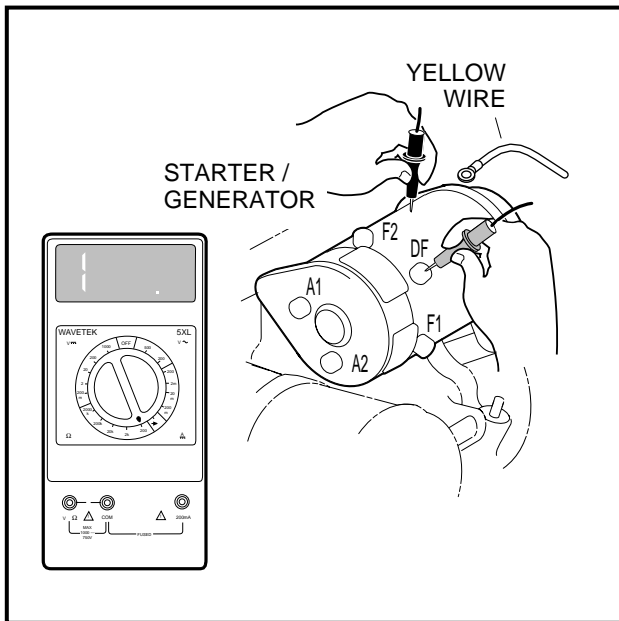
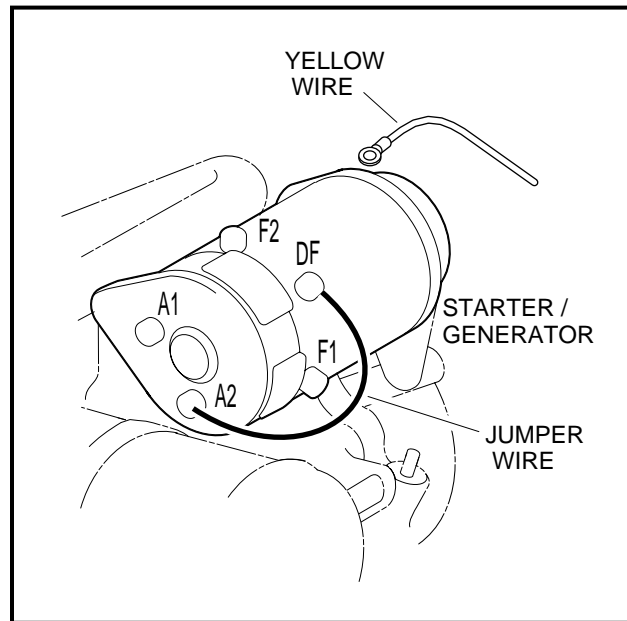
NOTE

- ENGINE ROTATION (CLOCKWISE) IS AS VIEWED FROM THE CLUTCH SIDE OF THE ENGINE.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. Check that wires are connected correctly and are tight. If they are not, rewire or tighten as necessary.
3. Disconnect the wires from all the terminals on the starter/generator. Then place the black (–) probe of a multimeter, set to 200 Ω (ohms), on the starter/generator housing (scratch through the paint to ensure a good ground). While holding the black probe against the housing, place the red (+) probe on the A1, A2, F1, F2 and DF terminals respectively (**Figure 11-33, Page 11-26**). The readings should be **NO** continuity. If the readings are incorrect, the starter/generator will need to be removed from the vehicle and disassembled by a qualified technician. **See Starter/Generator Removal, Section 12 – Electrical Components, Page 12-2.**

Test Procedure 8, Continued:

- An incorrect reading from A1 or A2 terminal indicates three possible problems: 1) a grounded A1 or A2 terminal, 2) a grounded wire in the brush area, or 3) a grounded armature/commutator.
 - If the F1 or F2 reading is incorrect, it indicates a possible grounded F1 or F2 terminal or a grounded field coil.
 - If the DF reading is incorrect, it indicates a possible grounded DF terminal or a grounded field coil.
4. Disconnect the ground wire from the A2 terminal and the green wire from the A1 terminal on the starter/generator.

**Figure 11-33 Check Terminal Continuity****Figure 11-34 Jumper Wire Ground – DF to A2**

5. Using a multimeter set to 200 Ω (ohms), place the red (+) probe on the A1 terminal and the black (–) probe on the A2 terminal. The reading should be continuity. If the reading is incorrect, a possible open or poor contact in a brush assembly and/or open armature windings may be the cause. The starter/generator will need to be removed from the vehicle and disassembled by a qualified technician. **See Starter/Generator Removal, Section 12 – Electrical Components, Page 12-2.**
6. With the wires still disconnected, using a multimeter set on 200 Ω (ohms), place the red (+) probe on the F1 terminal and the black (–) probe on the F2 terminal. The reading should be between approximately .1 and .3 Ω (ohms). If the reading is incorrect, a possible open field coil or bad connections at terminals may be the cause. The starter/generator will need to be removed from the vehicle and disassembled by a qualified technician **See Starter/Generator Removal, Section 12 – Electrical Components, Page 12-2.**
7. With the wires still disconnected, using a multimeter set on 200 Ω (ohms), place the red (+) probe on the DF terminal and the black (–) probe on the F1 terminal. The reading should be between 4.5 and 5.5 Ω (ohms). If the reading is incorrect, a possible grounded DF terminal and/or grounded field coil may be the cause. The starter/generator will need to be removed from the vehicle and disassembled by a qualified technician **See Starter/Generator Removal, Section 12 – Electrical Components, Page 12-2.**

TEST PROCEDURE 9 – WIRE CONTINUITY

Read **DANGER** and **WARNING** on page 11-1.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. To test a wire for continuity, disconnect either end from the electrical component it is attached to.
3. Set the multimeter to 200 Ω (ohms) and place the red (+) probe on the terminal at one end of the wire. Place the black (–) probe on the other terminal end of the wire. The reading should be continuity. If the reading is incorrect, repair or replace the wire.

TEST PROCEDURE 10 – STARTER/GENERATOR (GENERATOR FUNCTION)

Read **DANGER** and **WARNING** on page 11-1.

NOTE

- KEEP THE BATTERY CONNECTED WHILE PERFORMING TEST PROCEDURE 10.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in the NEUTRAL position, and chock the wheels.
2. Check to ensure that the wires are connected correctly and are tight. If they are not, rewire or tighten as necessary.
3. Disconnect the yellow wire from the DF terminal on the starter/generator. Cover the connector on the yellow wire to make sure the yellow wire will not short to ground. Then, using a jumper wire, ground the DF terminal to the A2 terminal (**Figure 11-34, Page 11-26**).
4. Using a multimeter set to volts DC (20v range), place the red (+) probe on the positive (+) post of the battery, and place the black (–) probe on the negative (–) post. Turn the key switch to the ON position, and depress the accelerator pedal to start the engine. Run the engine at full governed speed. The reading should show the voltage rising on the meter. If the voltage rises, **see Test Procedure 11 – Voltage Regulator, Page 11-27**. If the voltage does not rise, **see Disassembly of the Starter/Generator, Section 12 – Electrical Components, Page 12-3**.
5. Reconnect the yellow wire to the (DF) terminal on the starter/generator.

TEST PROCEDURE 11 – VOLTAGE REGULATOR

Read **DANGER** and **WARNING** on page 11-1.

NOTE

- KEEP THE BATTERY CONNECTED WHILE PERFORMING TEST PROCEDURE 11.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in the NEUTRAL position, and chock the wheels.
2. Check that wires are connected correctly and are tight. If they are not, rewire or tighten as necessary.
3. Check the engine RPM setting to ensure that it is correctly adjusted. **See Engine RPM Adjustment, Section 14 – Fuel System, Page 14-14**.
4. With the battery in good condition and fully charged, run the engine for several minutes to bring the voltage regulator to operating temperature.

Test Procedure 11, Continued:

5. Turn the key switch to OFF, killing the engine. Using a multimeter set to volts DC (DC V), place the red (+) probe on the large post of the solenoid (with the red wire from the voltage regulator attached). Place the black (–) probe on the negative (–) post of battery. Turn the key switch to the ON position. Depress the accelerator to start the engine, and run it at full governed speed. If the reading is between 14.7 and 15.3 volts, the regulator is good. If the reading is lower than 14.7 volts but rising steadily, check battery condition (**See Hydrometer Test, Page 11-19**). If the reading is lower than 14.7 volts and not rising, and the starter/generator is good; or if the reading is over 15.3 volts and continues to rise, replace voltage regulator (**Figure 11-36, Page 11-29**).

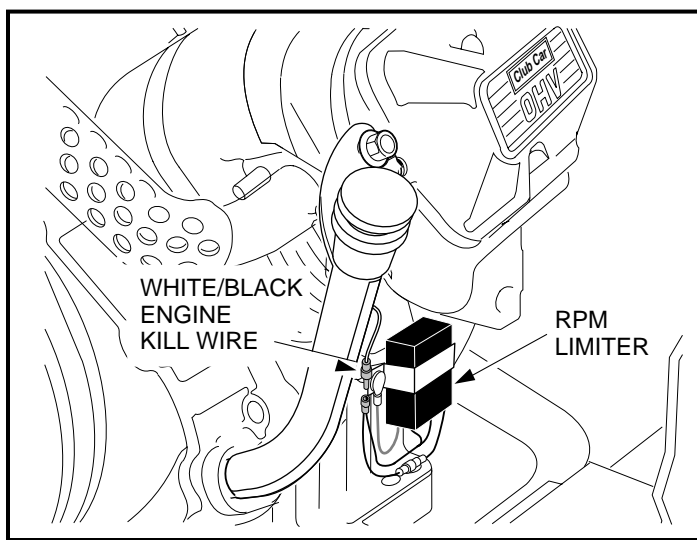


Figure 11-35 Disconnect White/Black Engine Kill Wire

TEST PROCEDURE 12 – DISCONNECTED KILL WIRE

Read **DANGER** and **WARNING** on page 11-1.

NOTE

- KEEP THE BATTERY CONNECTED WHILE PERFORMING TEST PROCEDURE 12.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in the NEUTRAL position, chock the wheels, and turn the key switch OFF.
2. Disconnect the engine kill white/black wire at the bullet connector located by the RPM limiter (**Figure 11-35, Page 11-28**).
3. With the neutral lockout cam in the SERVICE position, turn the key switch to the ON position. In a well-ventilated area, depress the accelerator to start the engine.
4. If the engine begins to run, test the engine kill circuit for a shorted wire or other failed components in the engine kill circuit. **See Test Engine Kill Circuit, Page 11-13. See following WARNING.**

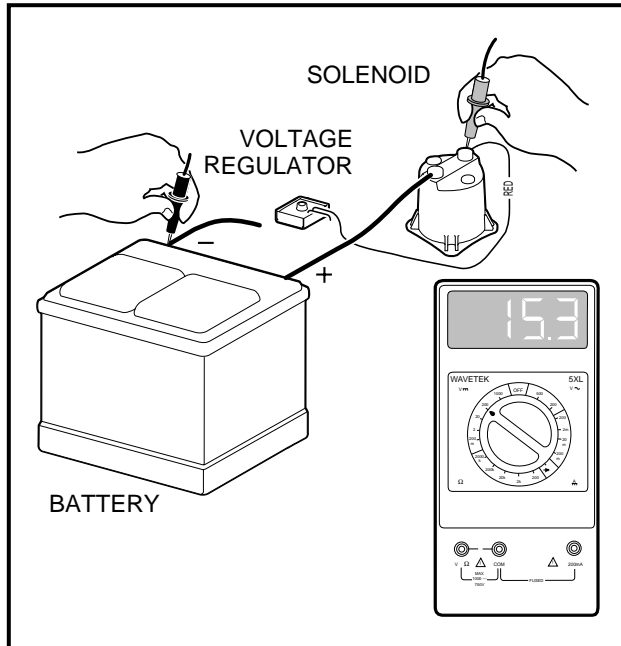
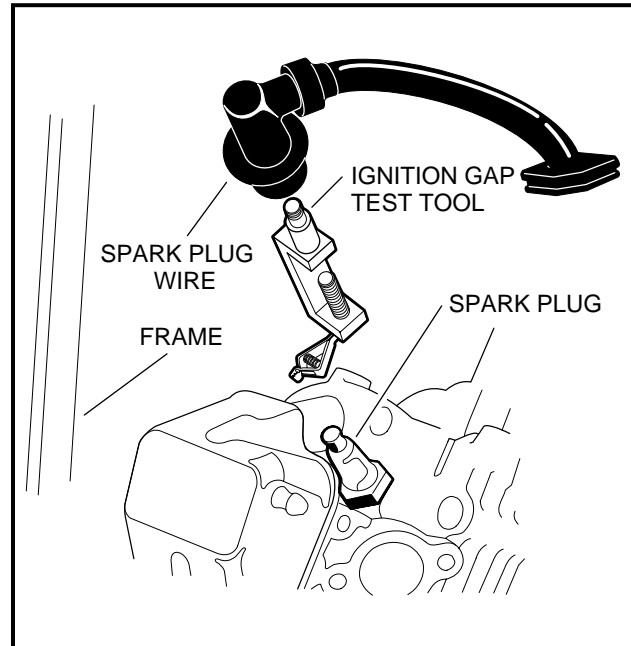
⚠ WARNING

- WHEN THE WHITE/BLACK ENGINE KILL WIRE IS DISCONNECTED, THE ENGINE WILL NOT STOP RUNNING AFTER THE ACCELERATOR PEDAL IS RELEASED. IT WILL BE NECESSARY TO DEPRESS AND HOLD THE CHOKE COVER CLOSED UNTIL THE ENGINE STOPS RUNNING.

5. If the engine fails to run, proceed to Test Procedure 13 – Ignition Spark.

TEST PROCEDURE 13 – IGNITION SPARK**Read DANGER and WARNING on page 11-1.****NOTE**

- KEEP THE BATTERY CONNECTED WHILE PERFORMING TEST PROCEDURE 13.

**Figure 11-36 Test Voltage Regulator****Figure 11-37 Ignition Spark Test**

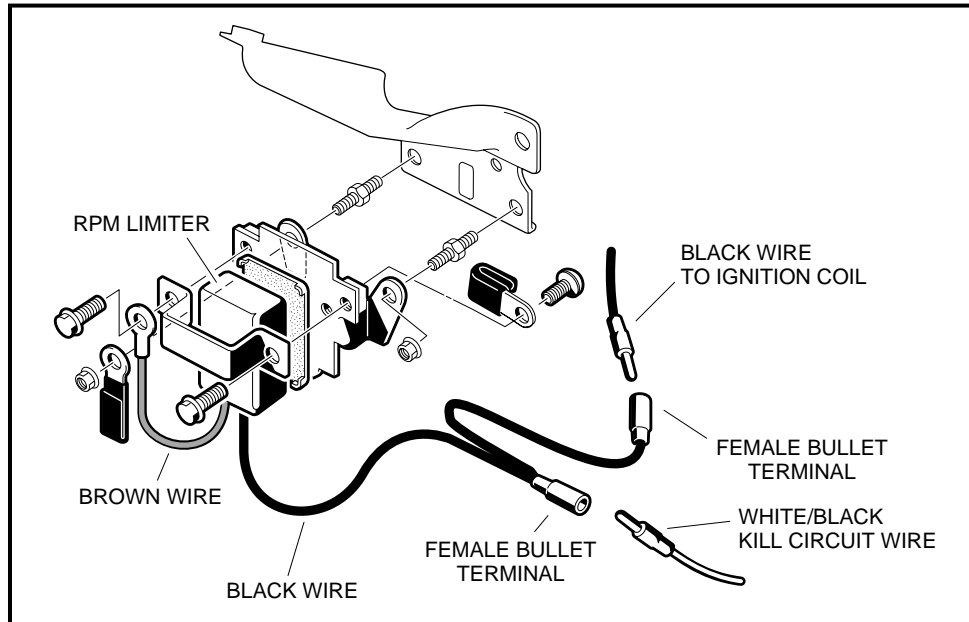
1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in the NEUTRAL position, and chock the wheels.
2. Remove the plug wire from the spark plug. Using an ignition spark gap test tool (Thexton 404[®] or equivalent), check for correct spark (**Figure 11-37, Page 11-29**).
 - 2.1. Adjust the tester probes to approximately to 18,000 volts (18 Kv) setting (SE – *small engine setting*–on the Thexton 404 tool). Connect the tester to the spark plug wire, and connect the alligator clip to a solid engine ground.
 - 2.2. Turn the key switch to the ON position and crank the engine by depressing the accelerator. There should be a strong blue spark between the probes of the spark gap tester. If there is no spark, or if the spark is a faint yellow or red color, test components of the ignition circuit.
3. If the spark gap tester tool indicates a strong blue spark, it is possible the spark plug has failed internally. Check the spark plug gap. The gap should be set at .027 to .031 of an inch (.69 to .79 mm). If the gap is correct, replace the spark plug with a new part and test the engine for proper operation.

TEST PROCEDURE 14 – RPM LIMITER**Read DANGER and WARNING on page 11-1.**

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. Disconnect both of the bullet terminals (**Figure 11-38, Page 11-30**).

Test Procedure 14, Continued:

3. Using a multimeter set on 200 Ω (ohms), place the red (+) probe on the brown ground wire and place the black (–) probe on one of the black wire female bullet connectors. The reading should be no continuity. If the reading is not correct, replace the RPM Limiter.
4. This test will find most bad RPM Limiters. Some of them may bench test okay but fail under a load due to heat while operating. Another method of testing is to replace the RPM Limiter and then run the engine. If the engine runs properly, keep the new RPM Limiter in the circuit.

**Figure 11-38 RPM Limiter****TEST PROCEDURE 15 – IGNITION COIL**

Read **DANGER** and **WARNING** on page 11-1.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. Using a multimeter set on 200 Ω (ohms), measure the primary coil resistance.
 - 2.1. Disconnect both of the bullet terminals at the RPM limiter. Place the black (–) probe of the meter on the male bullet terminal of the wire connecting the coil under the fan housing, and place the red (+) probe on a clean, unpainted surface of the engine or frame (**Figure 11-38, Page 11-30**).
 - 2.2. If the resistance is not between 0.6 - 1.7 Ω (ohms), remove the coil from the engine. **See Ignition Coil Removal, Section 12 – Electrical Components, Page 12-23.** Retest with a multimeter set on 200 Ω (ohms). Place the black (–) probe of the meter into the terminal on the coil (1), and place the red (+) probe on the core (2) (**Figure 11-39, Page 11-31**). If the resistance is still not between 0.6 - 1.7 Ω (ohms), replace the coil.
3. Using a multimeter set to 20k Ω (ohms), measure the secondary coil resistance.
 - 3.1. Remove the spark plug wire from spark plug. Place red (+) probe of the meter into the end of the spark plug wire and place black (–) probe on a clean, unpainted surface of the engine or frame.
 - 3.2. If the resistance is not between 6.0 - 11.0 k Ω (ohms), remove the coil from the engine. **See Ignition Coil Removal, Section 12 – Electrical Components, Page 12-23.** Retest with a multimeter set on 200 Ω (ohms). Place the black (–) probe of the meter on the core (2) and place the red (+) probe into the end of the spark plug wire (3) (**Figure 11-40, Page 11-31**). If the resistance is still not between 6.0 - 11.0 k Ω (ohms), replace the coil.

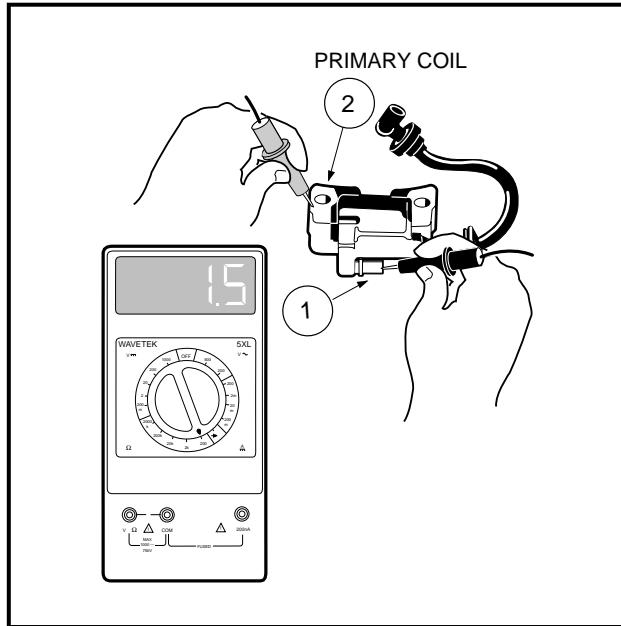


Figure 11-39 Test Primary Coil

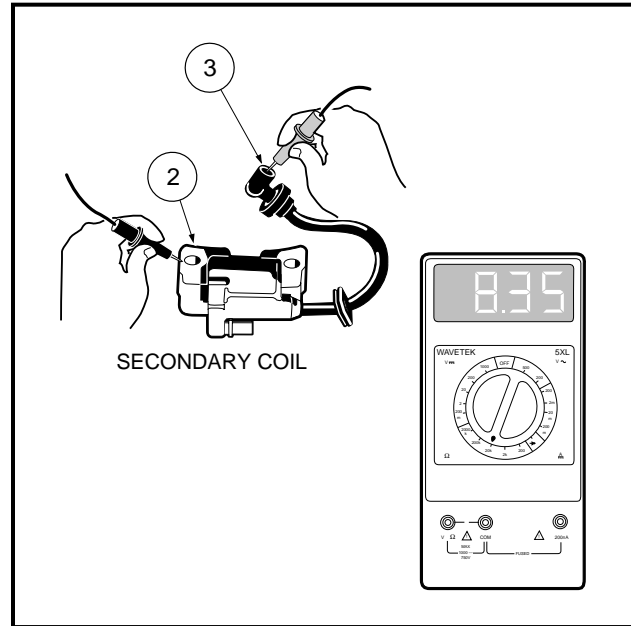


Figure 11-40 Test Secondary Coil

- These tests will find most of the bad coils. Some coils may bench test okay but fail under a load due to heat while operating. Another method of testing is to replace the coil and then run the engine. If the engine runs properly, keep the new coil in the circuit.

TEST PROCEDURE 16 – KILL LIMIT SWITCH

Read **DANGER** and **WARNING** on page 11-1.

The kill limit switch is located inside the electrical component box. The kill limit switch is the lower of the two limit switches and has a white/black wire and black wire connected to it.

- Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
- Check for proper wiring and tight connections.

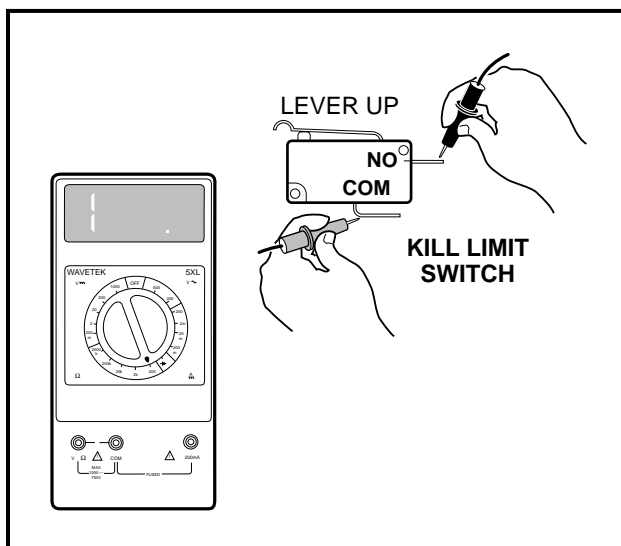


Figure 11-41 Test Kill Limit Switch

Test Procedure 16, Continued:

3. Disconnect wires from the limit switch and test the limit switch for continuity. Place the red (+) probe of the multimeter on the common (COM) terminal (white/black wire) of the limit switch. Place the black (–) probe on the normally open (NO) terminal (black wire) of the limit switch. Without the lever depressed, the reading should be **NO** continuity. Depress the lever, and the reading should be continuity. If either reading is incorrect, replace the limit switch (**Figure 11-41, Page 11-31**).
4. Reconnect wires to limit switch and check for tight connections.

TEST PROCEDURE 17 – KEY SWITCH (ENGINE KILL CIRCUIT)

Read **DANGER** and **WARNING** on page 11-1.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. Remove the center dash assembly. See **Key Switch Removal, Section 12 – Electrical Components, Page 12-13**.
3. Disconnect wires from the (+M) and (–M) terminals.
4. Place the red (+) probe of the multimeter on the (+M) terminal of the key switch and the black (–) probe on the (–M) terminal. With the key switch turned OFF, the reading should be continuity. With the key switch turned ON, the reading should be **NO** continuity. If the either reading is incorrect, replace the key switch (**Figure 11-42, Page 11-32**).
5. Reconnect wires to key switch. Make sure wires are connected correctly and are tight. If they are not, rewire or tighten as necessary.
6. Reinstall dash panel in reverse order of removal.

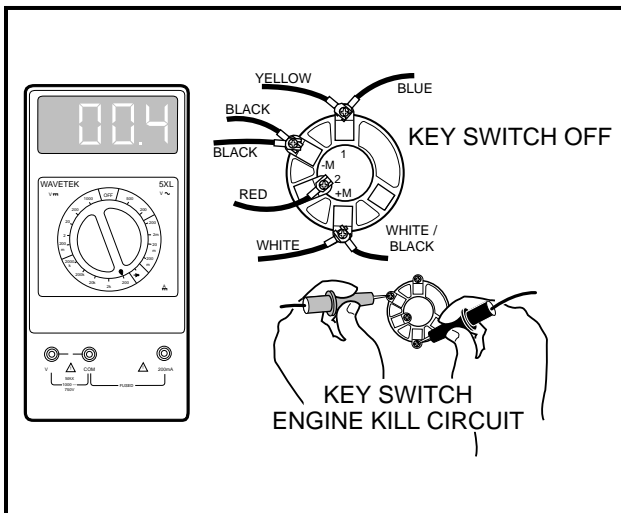


Figure 11-42 Test Key Switch – Engine Kill Circuit

TEST PROCEDURE 18 – ENGINE KILL WIRE

Read **DANGER** and **WARNING** on page 11-1.

1. Place the neutral lockout cam in the OPERATE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. Disconnect white/black wire bullet connector located at the engine RPM limiter (**Figure 11-35, Page 11-28**).
3. Connect red (+) probe of multimeter to the male bullet terminal on the white/black wire and connect the black (–) probe to the vehicle frame.

4. Turn the key switch ON, place the Forward/Reverse handle in FORWARD, and depress the accelerator pedal. There should be **NO** continuity. If there is continuity, check for worn insulation on the white/black wire that is allowing the wire to ground to the vehicle frame.

TEST PROCEDURE 19 – REVERSE BUZZER LIMIT SWITCH

Read **DANGER** and **WARNING** on page 11-1.

NOTE

- KEEP THE BATTERY CONNECTED WHILE PERFORMING TEST PROCEDURE 19.

The reverse buzzer limit switch is located on the Forward/Reverse shifter; red/white and orange wires are connected to it (**Figure 11-7, Page 11-9**).

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in the NEUTRAL position, and chock the wheels.
2. Move the Forward/Reverse handle to REVERSE and listen for an audible click from the limit switch. If there is no click, check the switch for proper alignment and switch arm movement.
3. If the switch is being activated but the buzzer does not function, place the red (+) probe of the multimeter on one terminal and the black (–) probe on the other terminal of the limit switch. Without the lever depressed, the reading should be **NO** continuity. Depress the lever and the reading should be continuity. If either reading is incorrect, replace the limit switch. **See Reverse Buzzer Limit Switch Removal, Section 12 – Electrical Components, Page 12-19.**

TEST PROCEDURE 20 – REVERSE BUZZER

Read **DANGER** and **WARNING** on page 11-1.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. Remove the center dash assembly. **See Key Switch Removal, Section 12 – Electrical Components, Page 12-13.**
3. Check for proper wiring and tight connections. Using a multimeter, individually check for continuity through each wire that connects to the reverse buzzer (**Figure 11-7, Page 11-9**). If the buzzer will not function when properly wired, replace the buzzer. **See Reverse Warning Buzzer Removal, Section 12 – Electrical Components, Page 12-19.**

TEST PROCEDURE 21 – OIL LEVEL SENSOR

Read **DANGER** and **WARNING** on page 11-1.

NOTE

- KEEP THE BATTERY CONNECTED WHILE PERFORMING TEST PROCEDURE 21.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in the NEUTRAL position, turn the key switch to the OFF position, disconnect the spark plug wire, and chock the wheels.
2. Ensure that the low oil warning light and all connecting wires are functioning correctly. **See Test Procedure 22, Page 11-34**
3. Drain the engine oil into an approved container and properly dispose of used oil.

Test Procedure 21, Continued:

4. Turn the key switch ON, closing the circuit. The oil light should illuminate. If the low oil warning light does not illuminate, the oil level sensor needs to be replaced. **See Oil Level Sensor Removal, Section 13 – FE290 Engine, Page 13-24.**
5. Fill the engine with new oil and install a new oil filter before returning the vehicle to service. **See Engine Oil, Section 10 – Periodic Maintenance, Page 10-6.**

TEST PROCEDURE 22 – OIL WARNING LIGHT

Read DANGER and WARNING on page 11-1.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse shifter handle in the NEUTRAL position, chock the wheels, and disconnect battery, negative cable first.
2. Remove the center dash assembly. **See Key Switch Removal, Section 12 – Electrical Components, Page 12-13.**
3. Check that the wires are connected correctly and are tight. If they are not, rewire or tighten as necessary (**Figure 11-8, Page 11-9**).
4. Disconnect the yellow wire (to the oil level sensor) from the terminal on the oil light. Using an alligator clip jumper wire, connect the oil light terminal to the frame of the vehicle. Connect the red (+) battery cable to the positive (+) post of the battery, then attach the black (–) cable to the negative (–) post of the battery.
5. Turn the key switch ON. The oil light should illuminate. If it does not, check continuity of the yellow wire from the key switch to the oil light. If there is **NO** continuity in the wire, replace the wire then test the key switch. **See Test Procedure 4 – Key Switch (Starter Circuit), Page 11-23.** If the yellow wire and the key switch test okay, then replace the oil light.

TEST PROCEDURE 23 – NEUTRAL LOCKOUT CAM

Read DANGER and WARNING on page 11-1.

1. Check to be sure the lobes on the cam are depressing the neutral lockout limit switch lever as the Forward/Reverse handle is being shifted. The limit switch should make an audible click as it is depressed. If it does not, check for wear on the cam lobes. Be sure the cam has snapped fully back into place. If the cam lobes still do not actuate the limit switch, replace the cam.

TEST PROCEDURE 24 – BATTERY TEST (UNDER LOAD)

Read DANGER and WARNING on page 11-1.

NOTE

- KEEP THE BATTERY CONNECTED WHILE PERFORMING TEST PROCEDURE 24.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in the NEUTRAL position, and chock the wheels.
2. Set a multimeter to 20 volts DC and place the red (+) probe on the F2 (white wire) terminal on the starter/generator. Place the black (–) probe on the negative terminal post on the battery.
3. Turn the key switch to the ON position, leave the Forward/Reverse shifter in the NEUTRAL position and depress the accelerator pedal (with the accelerator pedal depressed, the battery is under load).
 - 3.1. If the voltage reading is over 9.6 volts at 70 °F (21 °C) electrolyte temperature (**see following NOTE**), check the starter/generator. **See Starter/Generator, Page 11-2.**
 - 3.2. If the reading is below 9.6 volt at 70 °F (21 °C) electrolyte temperature (**see following NOTE**), check the battery. **See Test Procedure 2, Page 11-19.**

- 3.3. If the reading is zero, there may be **NO** continuity across the large posts of the solenoid. **See Test Procedure 6, Page 11-23.**

NOTE

- THE VOLTAGE READING LISTED IS FOR ELECTROLYTE AT 70 °F (21 °C). AT LOWER ELECTROLYTE TEMPERATURES THE VOLTAGE READING WILL BE LOWER.

4. If all of the test results are good and the voltage reading is zero, there may be a broken or damaged 6 gauge white wire from the solenoid to the starter/generator. **See Test Procedure 8 – Starter/Generator (Starter Function), Page 11-25.**

TEST PROCEDURE 25 – FUEL LEVEL SENDING UNIT

Read **DANGER** and **WARNING** on page 11-1.

⚠ WARNING

- TO AVOID THE POSSIBILITY OF FIRE OR EXPLOSION, MAKE SURE THE FUEL TANK CAP IS SECURELY IN PLACE WHILE PERFORMING THIS TEST PROCEDURE.

1. Turn the key switch to the OFF position, put the Forward/Reverse handle in the NEUTRAL position, disconnect the battery, negative (–) cable first, and chock the wheels.
2. Disconnect the orange wire from the center post of the fuel level sending unit.
3. With a multimeter set to 2 k Ω (ohms), place the red (+) probe of the multimeter on the center post of the sending unit. Place the black (–) probe on the ground connection of the sending unit (**Figure 11-43, Page 11-36**).
4. The following resistance readings (in ohms) should be obtained depending on the position of the float inside the fuel tank. The resistance reading will vary according to the exact position of the float. The chart below may be used as a guideline to determine if the fuel level sending unit is operating correctly. Make sure the float is at the surface of the fuel in the tank.

FLOAT POSITION	RESISTANCE READING	FUEL GAUGE READINGS
Lower Position (Tank Empty)	240 \pm 20 Ω (ohms)	Empty
Center Position (Tank Half Full)	120 \pm 20 Ω (ohms)	Half Full
Upper Position (Tank Full)	60 \pm 20 Ω (ohms)	Full

5. If the readings are within the specifications listed above, the fuel level sending unit is working properly. If the readings are incorrect, the fuel level sending unit has failed and the fuel tank must be replaced. **See Fuel Tank Removal in Section 14, page 14-23.**
6. If the readings are correct and the fuel gauge does not function correctly, check the continuity of the orange wire from the fuel level sending unit to the fuel/hour gauge. Leave the battery disconnected while checking continuity. Also check the continuity of the blue wire from the fuel/hour gauge to the key switch, and the black ground wires at the fuel level sending unit and at the fuel/hour gauge. **See Fuel/Hour Gauge Removal in Section 12, page 12-21.**
7. If the readings are correct according to the position of the float, but give an incorrect reading on the fuel/hour gauge, test the fuel/hour gauge. **See Test Procedure 26 – Fuel Gauge on page 11-36.**

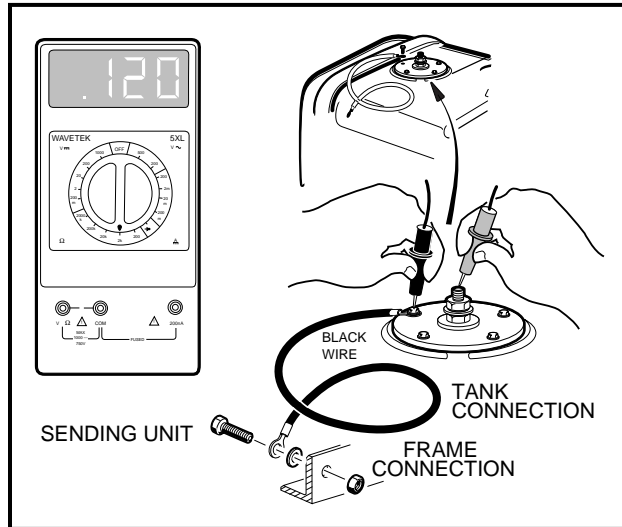


Figure 11-43 Test Fuel Level Sending Unit

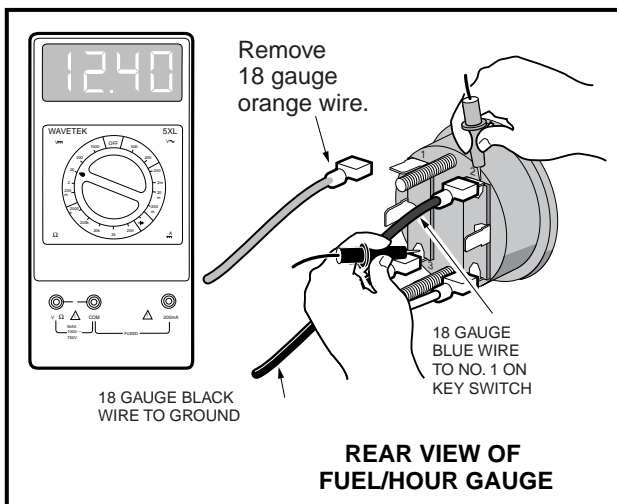


Figure 11-44 Test Fuel Gauge

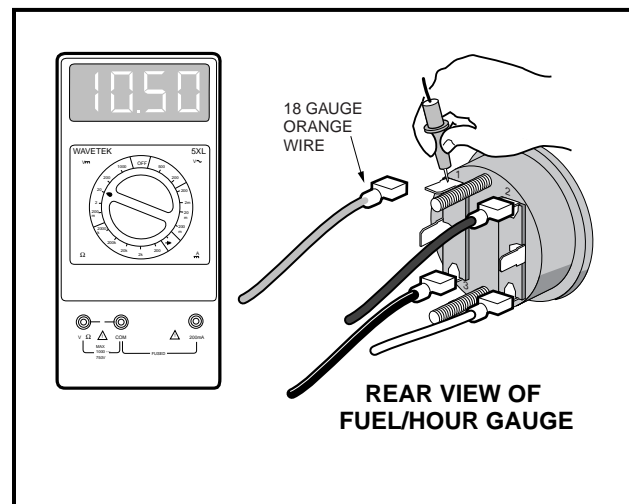


Figure 11-45 Test Fuel Gauge Voltage

TEST PROCEDURE 26 – FUEL GAUGE

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in NEUTRAL, chock the wheels and disconnect the battery, negative cable first.
2. Remove the center dash assembly to gain access to the back of the fuel gauge. **See Key Switch Removal, Section 12 – Electrical Components, Page 12-13.**
3. Place a sheet of insulating material between the front frame and the electrical connections on the rear of the center dash assembly to prevent contact between the two.
4. Disconnect the orange wire from the fuel gauge.
5. Set a multimeter to 20 volts DC and place the red (+) probe of the multimeter on the positive post of the battery. Place the black (–) probe on the negative post of the battery. Record the voltage reading.
6. Set a multimeter to 20 volts DC and place the red (+) probe of the multimeter on the (2) terminal of the fuel gauge with the blue wire. Place the black (–) probe on the (3) terminal of the fuel gauge with the black wire (**Figure 11-44, Page 11-36**).

7. Reconnect the battery cables, positive terminal first, and tighten to 20 ft-lb (27.1 N·m).
8. Turn the key switch ON. The voltage reading should be the same as the battery voltage reading recorded earlier. If not, check the continuity of the blue and black wires (**Figure 11-44, Page 11-36**).
9. Place the red (+) probe of the multimeter on the (1) terminal of the fuel gauge. Voltage should read between 10.0 volts and 10.5 volts. If the reading is incorrect, replace fuel gauge (**Figure 11-45, Page 11-36**).

TEST PROCEDURE 27 – HOUR GAUGE

Read **DANGER** and **WARNING** on page 11-1.

NOTE

- KEEP THE BATTERY CONNECTED WHILE PERFORMING TEST PROCEDURE 27.

1. Place the Forward/Reverse handle in the NEUTRAL position, place the neutral lockout cam in the SERVICE position, and chock the wheels.
2. Turn the key switch to ON and record the current hour gauge reading.
3. Depress and hold the accelerator pedal to run the engine for at least six minutes (the meter records in six-minute increments). **See following DANGER.**

DANGER

- DO NOT OPERATE VEHICLE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. THE ENGINE PRODUCES CARBON MONOXIDE, WHICH IS AN ODORLESS, DEADLY POISON.

4. If the reading does not change after six minutes, then replace the fuel/hour gauge.

SECTION 12 – ELECTRICAL COMPONENTS

DANGER

- **BATTERY – EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM THE VEHICLE AND SERVICE AREA. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR A FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.**
- **BATTERY – POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES OR CLOTHING. ANTIDOTES:**
 - **EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.**
 - **INTERNAL: DRINK LARGE QUANTITIES OF WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.**
 - **EYES: FLUSH WITH WATER FOR 15 MINUTES. CALL A PHYSICIAN IMMEDIATELY.**
- **GASOLINE – FLAMMABLE! EXPLOSIVE! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM VEHICLE AND SERVICE AREA. SERVICE ONLY IN A WELL-VENTILATED AREA.**
- **DO NOT OPERATE VEHICLE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. THE ENGINE PRODUCES CARBON MONOXIDE, WHICH IS AN ODORLESS, DEADLY POISON.**

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR. FOLLOW ALL PROCEDURES EXACTLY AND HEED ALL WARNINGS STATED IN THIS MANUAL.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY BEFORE SERVICING THE VEHICLE.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- **FRAME GROUND – DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR ANY OTHER ELECTRIC WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR ANY OTHER METAL COMPONENT.**
- **HOT! DO NOT ATTEMPT TO SERVICE HOT ENGINE OR EXHAUST. CAN CAUSE SEVERE BURNS. ALWAYS ALLOW ENGINE AND EXHAUST TO COOL PRIOR TO SERVICING.**
- IF WIRES ARE REMOVED OR REPLACED, MAKE SURE WIRING IS PROPERLY ROUTED AND SECURED TO VEHICLE FRAME. FAILURE TO PROPERLY ROUTE AND SECURE WIRING COULD RESULT IN VEHICLE MALFUNCTION, PROPERTY DAMAGE OR PERSONAL INJURY.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (–) FIRST (**FIGURE 12-1, PAGE 12-2**).
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.

WARNING CONTINUED ON NEXT PAGE...

⚠ WARNING

- FOR VEHICLES WITH CARGO BEDS, REMOVE ALL CARGO BEFORE RAISING THE BED. DO NOT CLOSE BED UNTIL ALL PERSONS ARE CLEAR OF CARGO BED AREA. KEEP HANDS CLEAR OF CRUSH AREA BETWEEN BED AND SEAT BACK SUPPORT. DO NOT DROP CARGO BED; LOWER GENTLY AND KEEP ENTIRE BODY CLEAR. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SEVERE PERSONAL INJURY.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, SET THE PARK BRAKE WHEN LIFTING THE FRONT OF THE VEHICLE, UNLOAD THE CARGO BED AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. USE APPROVED JACK STANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.

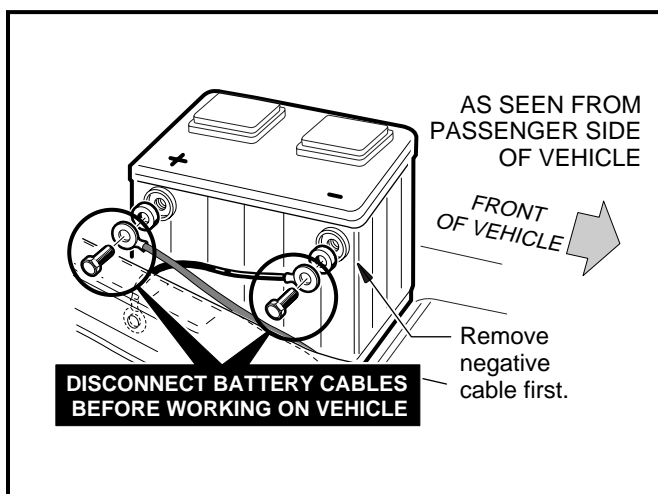


Figure 12-1 Battery Disconnect

STARTER/GENERATOR

Read **DANGER** and **WARNING** on page 12-1.

Testing the Starter/Generator

See Section 11, Test Procedure 8, Page 11-25 and Test Procedure 10, Page 11-27.

Starter/Generator Removal

1. Disconnect the battery as shown ((**Figure 12-1, Page 12-2**).
2. Remove the access panel on a DS Golf Car or Villager 4 vehicle; lift the cargo bed on a Turf or Carryall vehicle.
3. Disconnect the wires from the starter/generator (1). Mark wires before disconnecting. Loosen the pivot nuts (7) and bolts (5) (**Figure 12-2, Page 12-3**).
4. Remove the mounting/adjustment nut (12), washer (9) and bolt (11). Lower the starter/generator and remove the belt (4) from the pulley (10) (**Figure 12-2, Page 12-3**).
5. Support the starter/generator so that when the pivot bolts are removed the starter/generator will not fall to the ground. Remove the pivot nuts (7) and bolts (5) from the mounting bracket.
6. Remove the starter/generator from the vehicle.

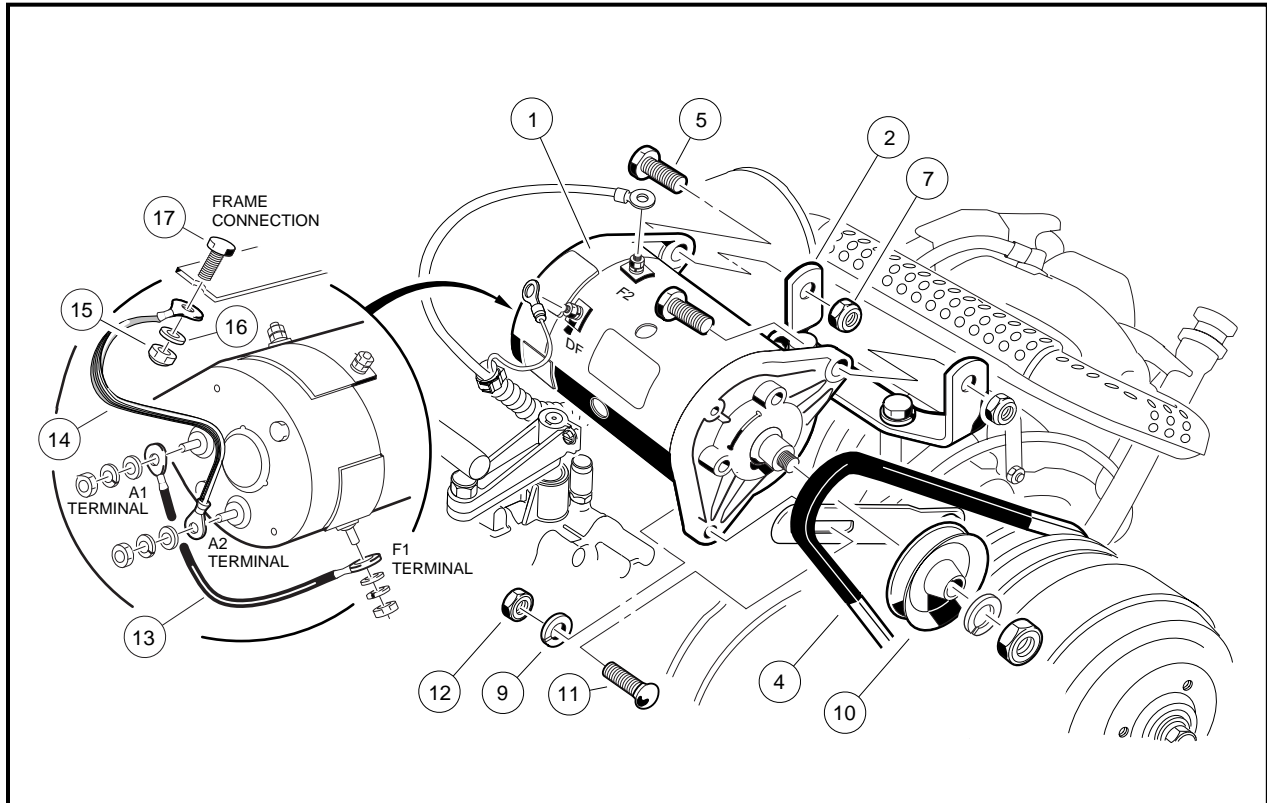


Figure 12-2 Starter/Generator Removal

Disassembly of the Starter/Generator to Service the Brushes

1. Remove the two bolts (20) and pull commutator end cover (23) free of starter/generator housing (24) (Figure 12-3, Page 12-4). See following **NOTE**.

NOTE

- IF THE BRUSHES ARE NOT REMOVED, CONTACT BETWEEN THE BRUSHES AND COMMUTATOR AS THE COMMUTATOR END COVER IS BEING REMOVED OR INSTALLED COULD DAMAGE THE BRUSHES. LIFT THE BRUSH SPRINGS OUT OF THE NOTCHES IN THE BRUSHES AND PULL THE BRUSHES BACK FROM THE CENTER OF THE COMMUTATOR END COVER. THE SPRINGS WILL REST ON THE SIDES OF THE BRUSHES AND HELP PREVENT THEM FROM SLIDING TOWARDS THE CENTER OF THE COVER (**FIGURE 12-7, PAGE 12-5**).

2. Remove brush covers (29 and 30), screws (25) and lockwashers (26), brush springs (28), and brushes (27) (**Figure 12-4, Page 12-4**).

NOTE

- TO CLEAN AND INSPECT THE ARMATURE/COMMUTATOR AND BEARINGS, **SEE DISASSEMBLY OF THE STARTER/GENERATOR TO SERVICE THE ARMATURE/COMMUTATOR, PAGE 12-5**.

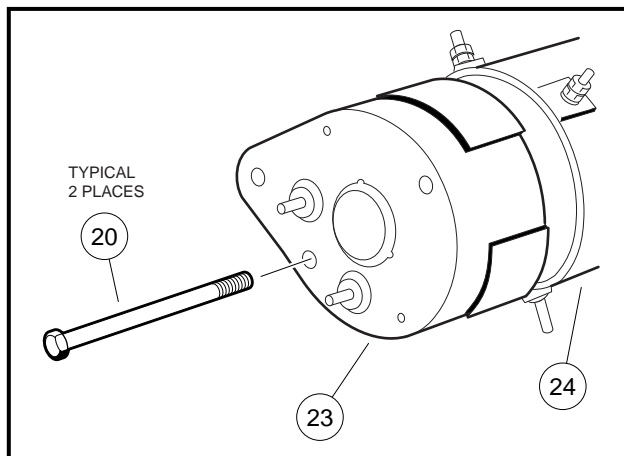


Figure 12-3 Commutator End Cover

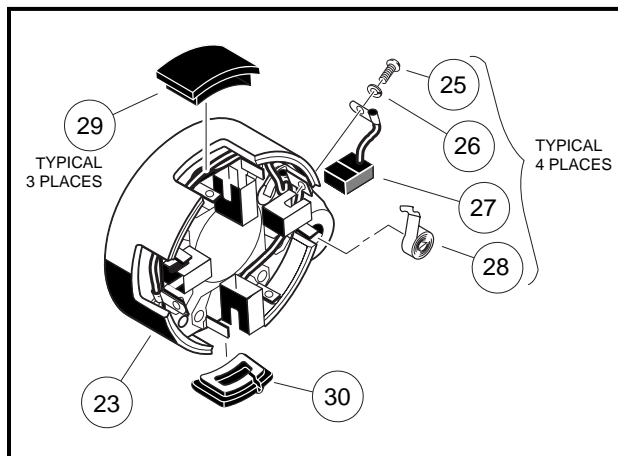


Figure 12-4 Brush Installation

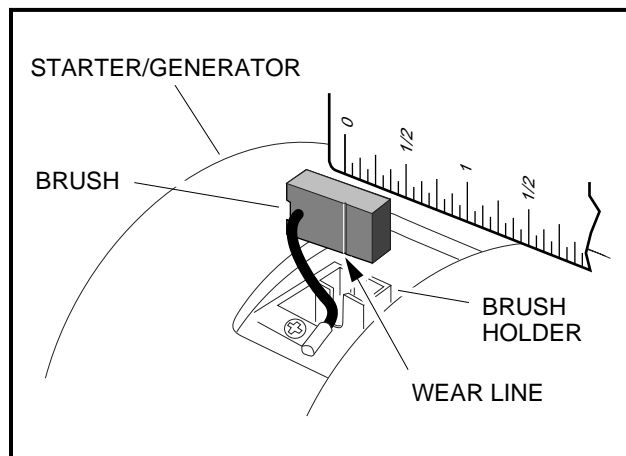


Figure 12-5 Inspect Brushes

Brush Inspection and Replacement

1. Visually inspect brushes. Replace brushes that are cracked or severely chipped.
2. Check the wear line on the side of the brush. If the end of the brush is within 1/16 of an inch (1.6 mm) of the wear line, replace all four brushes (**Figure 12-5, Page 12-4**).

Brush Spring Inspection and Replacement

1. Visually inspect springs. Replace all four springs if any spring is discolored from heat (straw or bluish in color).
2. Install the four brushes (27) into their holders and insert the four brush springs (28) (**Figure 12-4, Page 12-4**). Using a spring scale, test brush spring tension. If any spring has a tension less than 24 ounces, replace all four springs (**Figure 12-6, Page 12-5**). See following **CAUTION**.

CAUTION

- WHEN CHECKING BRUSH SPRING TENSION, DO NOT PUSH SPRINGS BEYOND THE POINT THEY WOULD NORMALLY BE IF THERE WERE NEW BRUSHES INSTALLED. EXERTING EXCESSIVE FORCE OR PUSHING BRUSH SPRINGS BEYOND THEIR NORMAL MAXIMUM EXTENSION POINT WILL DAMAGE SPRINGS.

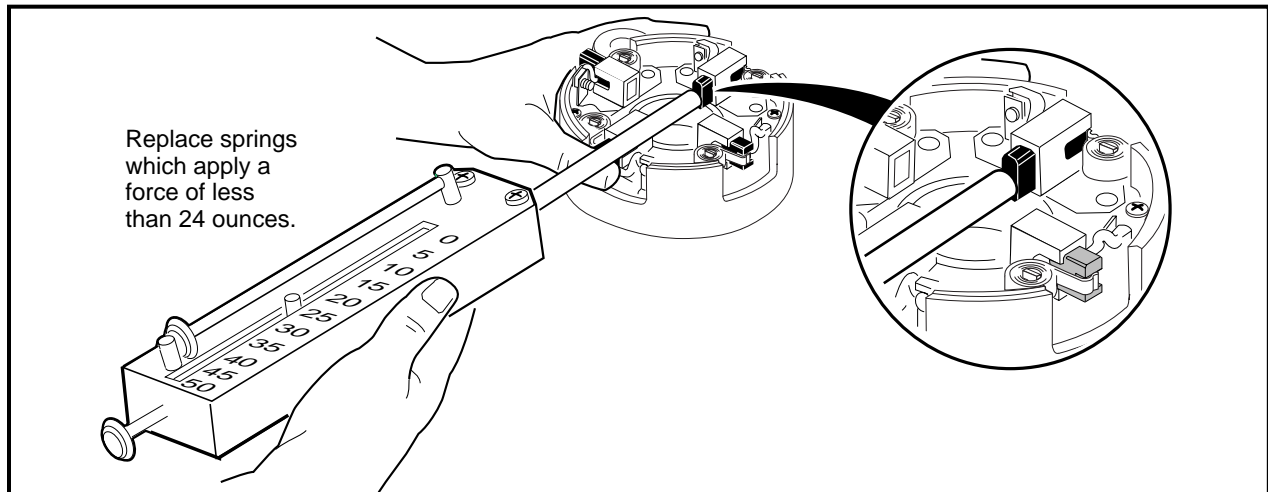


Figure 12-6 Brush Spring Tension Test

Starter/Generator Assembly

1. Connect the brush wires to the holders using four lockwashers (26) and four screws (25), making sure the crossover leads are connected also. Tighten the screws to 31 in-lb (3.5 N-m) (**Figure 12-4, Page 12-4**).
2. To prevent contact between the brushes and commutator as the commutator is installed, and possible damage to the brushes, lift the brush springs out of the notches in the brushes and pull the brushes back from the center of the commutator end cover. The springs will rest on the sides of the brushes and help prevent them from sliding towards the center of the cover (**Figure 12-7, Page 12-5**).
3. Install the commutator end cover (23) onto the armature shaft. Align the locating pin with the pin hole in the cover. Install two M6 x 1 x 180mm bolts (20) and tighten to 100 in-lb (11.3 N-m) (**Figure 12-3, Page 12-4**).
4. Push the brushes down into the holders. Position springs into the notches in the brushes. Install the brush cover (30) that has the drain hole in it next to the A2 terminal. Install the remaining three brush covers (29) in the openings in the commutator end cover (23) (**Figure 12-4, Page 12-4**).

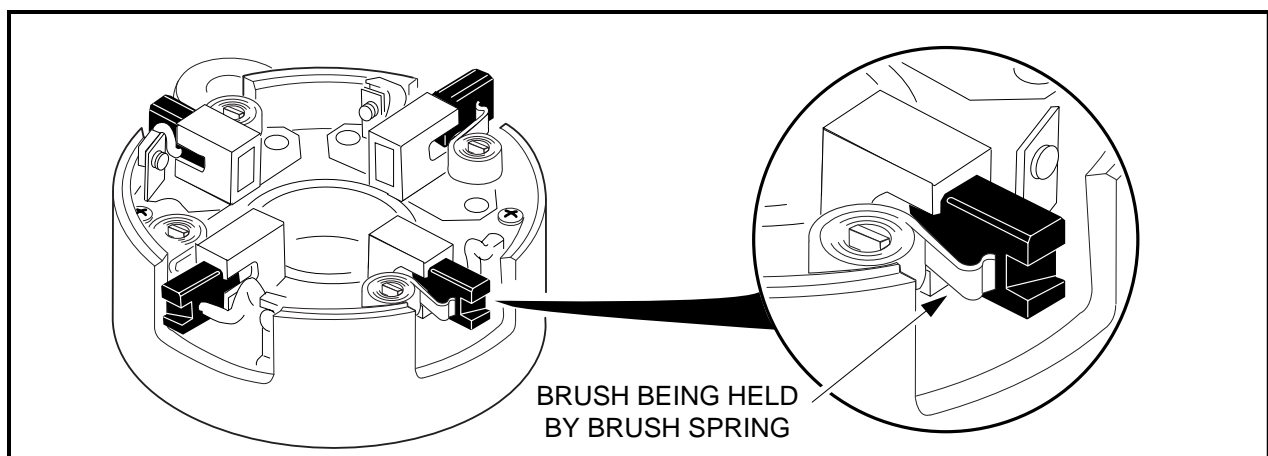


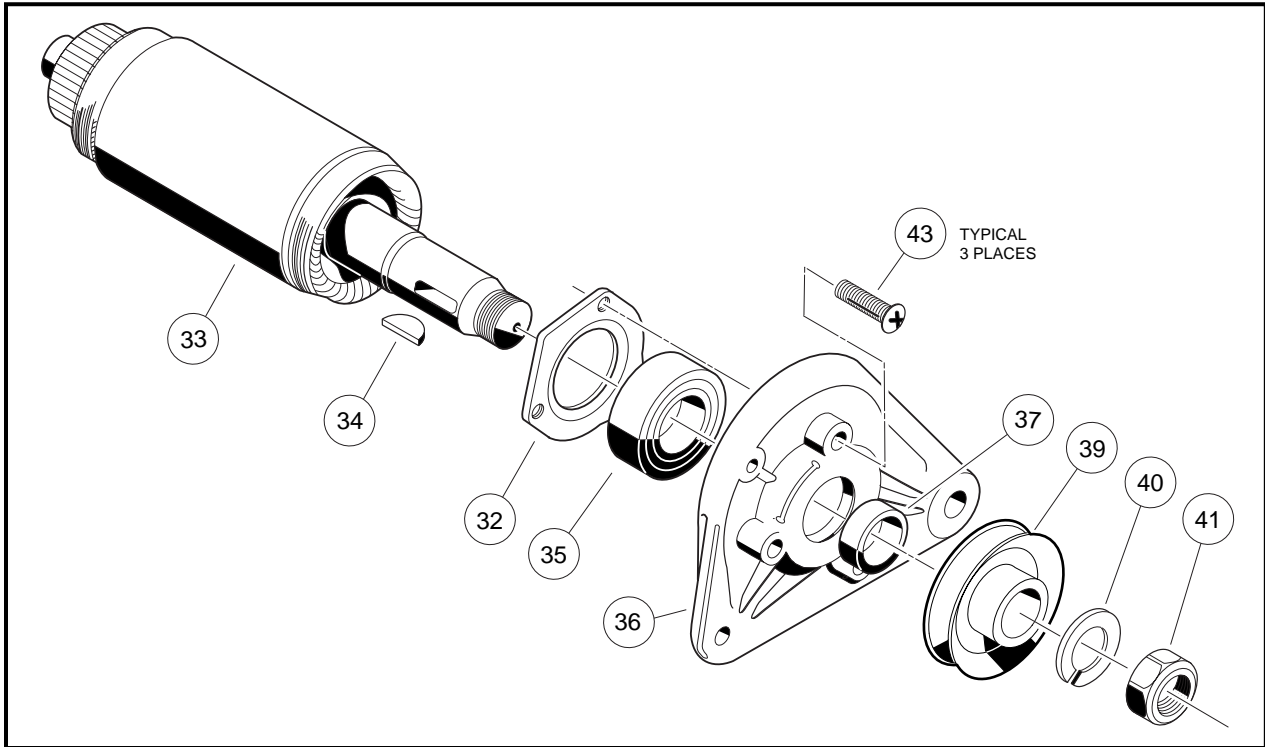
Figure 12-7 Pull Brushes Away from Center of the Commutator End Cover

Disassembly of the Starter/Generator to Service the Armature/Commutator

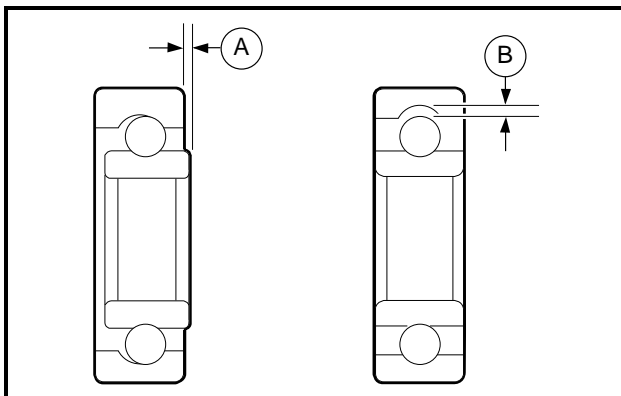
1. If the brushes are not removed, contact between the brushes and commutator as the commutator end cover is being removed or installed could damage the brushes.
 - 1.1. Lift the brush springs out of the notches in the brushes and pull the brushes back from the center of the commutator end cover. The springs will rest on the sides of the brushes and help prevent them from sliding towards the center of the cover (**Figure 12-7, Page 12-5**).

Disassembly of the Starter/Generator, Continued:

2. Remove the two bolts (20) and pull commutator end cover (23) free of the starter/generator housing (24) (**Figure 12-3, Page 12-4**).
3. To separate armature (33) from output end cover (36), remove nut (41), lockwasher (40), pulley (39), shaft key (34), spacer (37) and bearing retainer screws (43) (**Figure 12-8, Page 12-6**).

**Figure 12-8 Armature and Output End Cover Assembly****Bearing Cleaning and Inspection**

1. Using a clean cloth, wipe the carbon dust from the two bearings. Inspect bearings by spinning them by hand and checking for both axial (A) and radial (B) play (**Figure 12-9, Page 12-6**).
2. Replace the bearing if it is noisy, does not spin smoothly, or has excessive play. Check the bearings and replace if rusted, worn, cracked, or if there is an abnormal color change in the metal of the bearing. Bearings should be replaced if there is extensive wear or pitting on the balls or on the rolling surfaces. Do not remove the bearings unless they are to be replaced.

**Figure 12-9 Bearing Play Inspection**

Bearing Removal

1. Place the wedge attachment tool (Club Car Part No. 1012812) between the bearing and the armature. Make sure the wedge attachment tool is supporting the inner race of the bearing. If a press is not available, secure a bearing puller (Club Car Part No. 1012811) to the wedge attachment tool and pull the bearing off of the end of the armature shaft. Support the armature so that it will not drop when the bearing is removed (**Figure 12-10, Page 12-7**).
2. Discard the bearings.
3. Slide the bearing retainer (32) off of the output end of the shaft (**Figure 12-8, Page 12-6**).

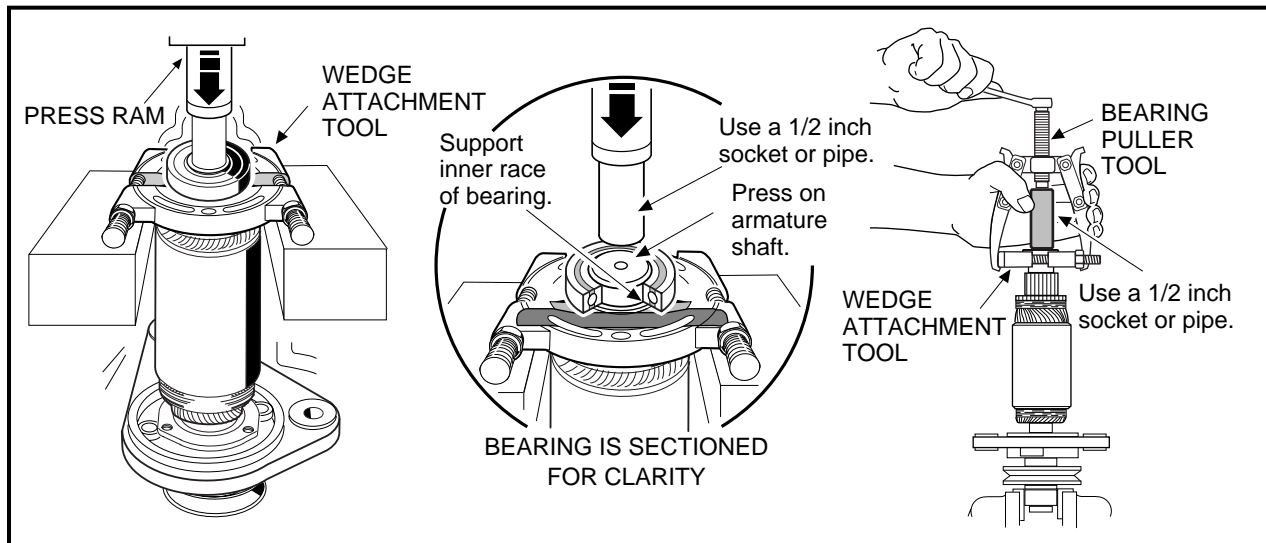


Figure 12-10 Bearing Removal

Field Coil Removal

1. Remove the retaining nut from each field coil terminal and slide the insulator out of the slots in the housing. Remove the four pole piece screws from the housing. Remove the four pole pieces from inside the housing. Remove the field coils from the inside of the housing (**Figure 12-11, Page 12-8**). **See following NOTE.**

NOTE

- DO NOT REMOVE THE INSULATORS OR THE FIELD COILS UNLESS AN ELECTRICAL TEST INDICATES THAT IT IS NECESSARY (**FIGURE 12-11, PAGE 12-8**). **SEE SECTION 11, TEST PROCEDURE 8, PAGE 11- 25.**

Visual Inspection of Armature

Obvious defects can be seen by examining the armature. If an armature has frayed or charred insulation, broken wires or thrown solder, it is obvious without testing that it should be replaced. Faults seen during the visual inspection can aid in diagnosing the original cause of the failure. Items to look for are listed below.

- Burned, charred, or cracked insulation
- Improperly cured varnish
- Thrown solder
- Flared armature windings
- Worn, burned, or glazed commutator
- Loose or raised commutator bars
- Bruised or damaged armature core laminations
- Worn armature bearing or shaft
- Dirty or oily commutator

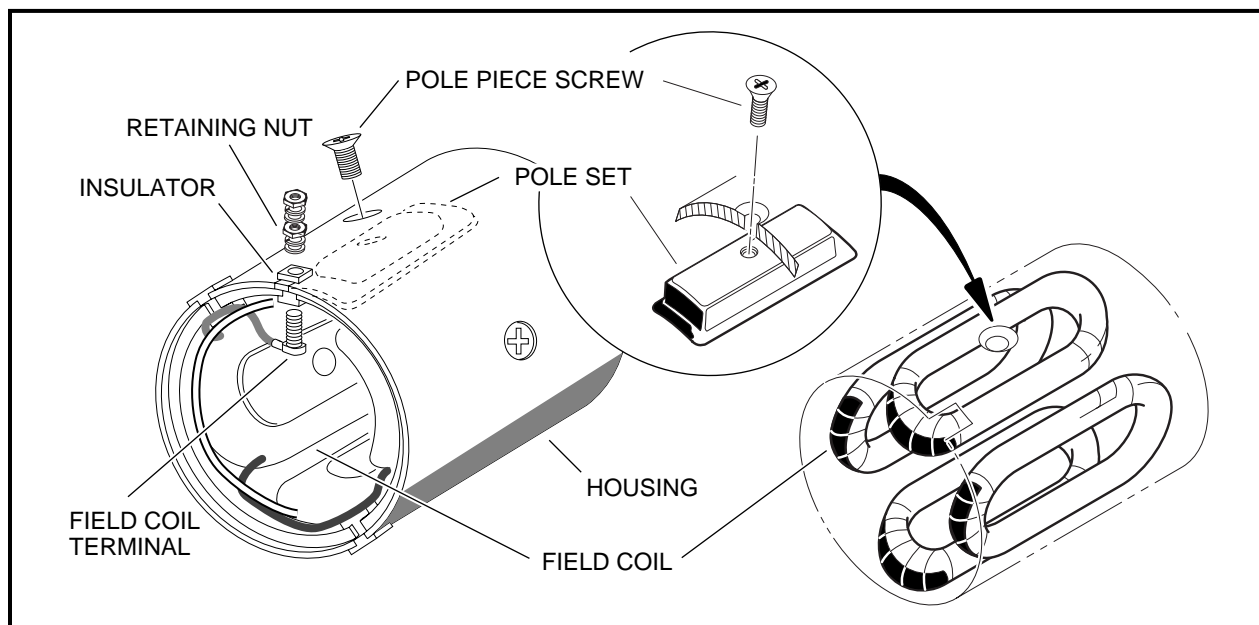


Figure 12-11 Field Coil Assembly

Commutator Cleaning, Inspection, and Replacement

1. Clean the carbon dust, dirt and oil from the commutator. Visually inspect the commutator for worn, burned or glazed areas. Check for loose or raised commutator bars. Slight roughness of the commutator can be polished away with 400 grit (or finer) sandpaper. **See following CAUTION.**

⚠ CAUTION

- NEVER USE EMERY CLOTH ON THE COMMUTATOR. PARTICLES OF EMERY ARE CONDUCTIVE AND MAY SHORT-CIRCUIT THE COMMUTATOR BARS. NEVER USE OIL OR LUBRICANTS ON THE COMMUTATOR OR BRUSHES.

2. Using a micrometer, measure the outside diameter at two points along the commutator. If the commutator outside diameter is less than 1.535 inches (39 mm), replace the armature and bearings (**Figure 12-12, Page 12-8**).

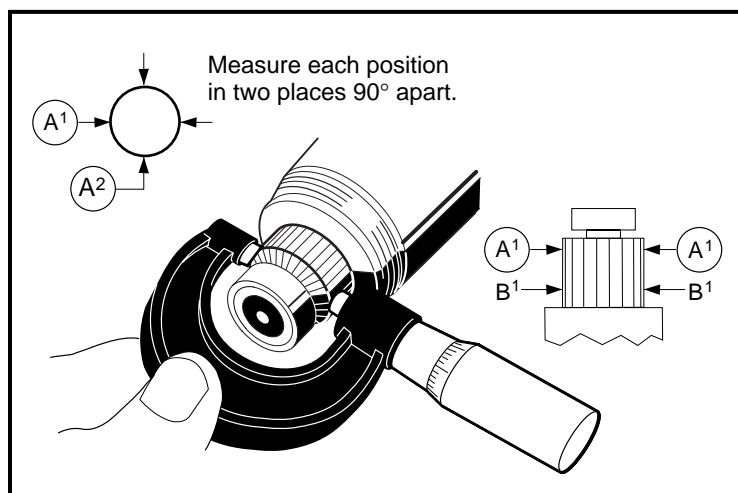


Figure 12-12 Inspect Commutator

Armature Ground Test

⚠ CAUTION

- DO NOT SUBMERGE ARMATURE IN SOLVENT.

NOTE

- BEFORE TESTING, WIPE THE ARMATURE WITH A CLEAN CLOTH AND REMOVE CARBON DUST AND METAL PARTICLES FROM BETWEEN COMMUTATOR BARS.

1. Using a multimeter set on 200 Ω (ohms), place the positive probe on the commutator bars and the negative probe on the armature core. The reading should be **NO** continuity. If the reading is incorrect, replace the armature and the two bearings (**Figure 12-13, Page 12-9**).

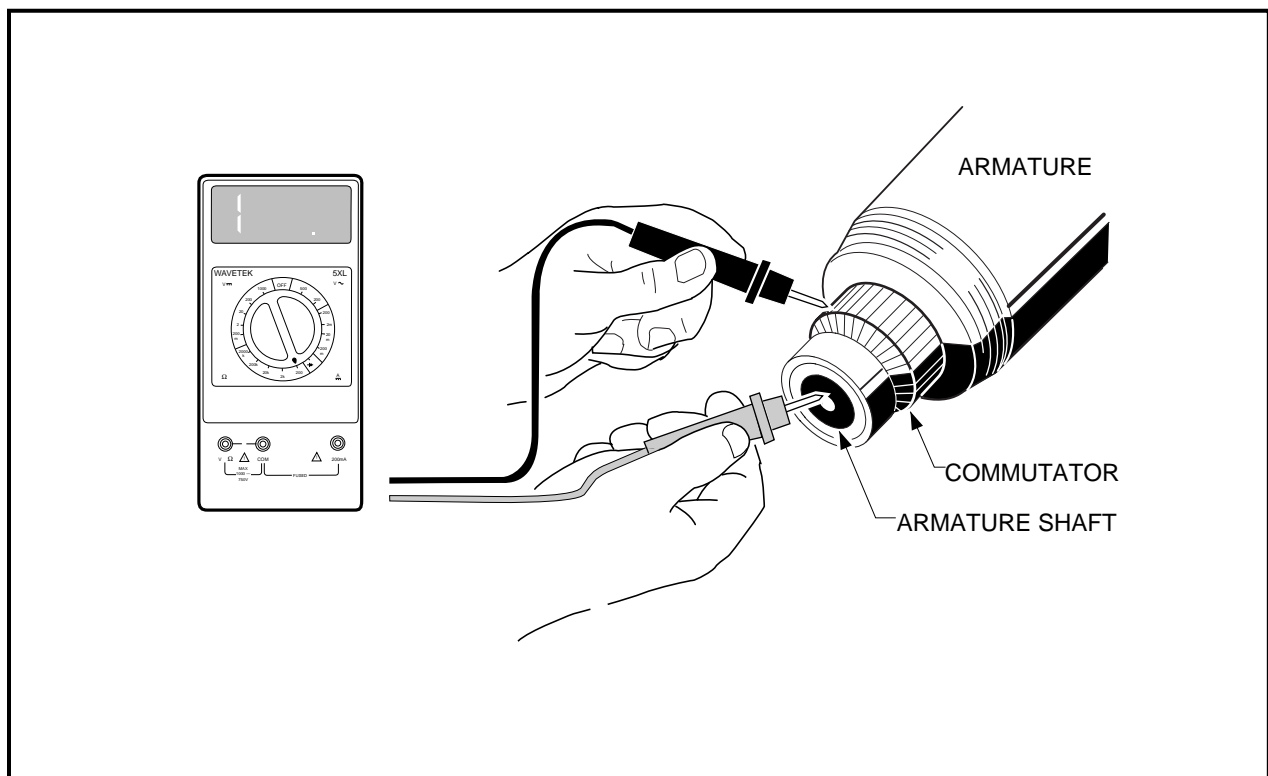


Figure 12-13 Armature Ground Test

Visual Inspection of Field Coils

If the insulation on the field coils appears blackened or charred, the serviceability of the coils is questionable. Burned or scorched coil insulation indicates the starter/generator has overheated due to overloads or grounded or shorted coil windings. Be sure the insulators are tight in the housing.

Starter/Generator Rework

Any rework must be performed by a qualified technician. Starter/Generator service specifications are listed in the following table.

ITEM	SERVICE LIMIT
Commutator diameter (minimum)	1.535 inches (39 mm)
Concentric with armature shaft within	0.002 inch (0.051 mm)
Limit depth of cut when machining commutator	0.007 inch (0.2 mm)
If undercut of segment insulator is less than 0.016 inch (0.406 mm), then it should be undercut to	0.031 inch (0.78 mm)
Dielectric strength	500 VAC for one minute
Armature insulation resistance	0.2M Ω (ohms) at 500 VDC
Starter field coil resistance	0.006-0.01 Ω (ohms)
Generator field coil resistance	4.5-5.5 Ω (ohms)

Starter/Generator Assembly

1. Place the field coil into the housing. The two insulators that look alike fit into the slots next to the F1 and F2 markings on the outside of the housing. The insulator that looks different slides into the slot next to the DF marking.
2. After the insulators are seated in the slots, install the threaded terminals through the wire connectors and then through the insulators. Install a flat washer, lockwasher and nut onto each threaded terminal on the outside of the housing and tighten to 47.5 in-lb (5.4 N-m) **(Figure 12-11, Page 12-8)**.

CAUTION

- ROUTE THE FIELD TERMINAL WIRES SO THAT THEY WILL NOT CONTACT THE ARMATURE.

3. Install the four pole pieces into the housing. Use the four screws to secure pole pieces to the inside of the housing to retain the field wires. Tighten screws to 9 ft-lb (12 N-m) **(Figure 12-11, Page 12-8)**.
4. Slide the bearing retainer onto the output end of the armature shaft (33) so that it will hold the outside of the bearing (35) only.
5. Press a new ball bearing (35) onto the output end of the armature **(Figure 12-8, Page 12-6)**. Press a new ball bearing onto the commutator end of the armature shaft. **See following CAUTION.**

CAUTION

- TO PREVENT DAMAGE TO THE RETAINER, USE CARE WHILE PRESSING NEW BEARING ONTO THE OUTPUT END OF THE SHAFT.
- PRESS AGAINST THE INNER RACE OF THE NEW BEARING UNTIL IT IS FULLY SEATED.

6. Install the output end cover (36) onto the armature. Secure the bearing retainer (32) to the cover using three M5 x .8 x 18mm screws (43) and tighten to 39 in-lb (4.4 N-m) **(Figure 12-8, Page 12-6)**.
7. Slide the housing with field coils over the armature. Use the locating pin to align housing with the cover.

NOTE

- THE TERMINAL INSULATORS SHOULD BE ON THE COMMUTATOR END OF THE HOUSING.

8. To prevent contact between the brushes and commutator as the commutator cover is installed, and possible damage to the brushes, lift the brush springs out of the notches in the brushes and pull the brushes back from the center of the commutator end cover. The springs will rest on the sides of the brushes and help prevent them from sliding towards the center of the cover **(Figure 12-7, Page 12-5)**.

9. Install the commutator end cover (23) onto the armature shaft. Align the locating pin with the pin hole in the cover. Install two M6 x 180mm screws (20) and tighten to 100 in-lb (11.3 N·m) (**Figure 12-3, Page 12-4**).
10. Install the brushes into the holders. Place springs into the notches in the brushes. Install the brush cover (30) that has the drain hole in it next to the A2 terminal. Install the remaining three brush covers (29) in the openings in the commutator end cover (23) (**Figure 12-4, Page 12-4**).
11. Slide the spacer (37) onto the end of the shaft. Insert the shaft key (34) into the shaft. Install the belt pulley (39) onto the shaft and install the lockwasher (40) and nut (41) and tighten to 28 ft-lb (38.0 N·m) (**Figure 12-8, Page 12-6**).

Starter/Generator Installation

1. Install the green wire from the F1 terminal to the A1 terminal on the Starter/Generator (**Figure 12-2, Page 12-3**). Install a flat washer, lockwasher and nut onto each terminal and tighten to 48 in-lb (5.4 N·m).
2. Install the two 3/8 hex head pivot screws (5) into the mounting bracket with the heads of the screws facing toward the driver side of the vehicle. Position the starter/generator in the mounting bracket so that the screws will go through the starter/generator before going through the bracket. Install a locknut (7) onto each screw. Finger-tighten the screws and nuts (**Figure 12-14, Page 12-11**).
3. Install the adjustment bolt (11) through the adjusting bracket (4) and then through the starter/generator. Install a lockwasher (9) and 5/16 nut (12) onto the end of the adjustment bolt (11). Tighten to finger tight (**Figure 12-14, Page 12-11**).
4. Install the belt (3) then tighten the mounting screws. **See Belt Adjustments.**
5. Connect the yellow wire from the voltage regulator to the DF terminal on the starter/generator (**Figure 12-2, Page 12-3**). Install a flat washer, lockwasher, and nut onto the terminal. Tighten the nut to 31 in-lb (3.5 N·m).
6. Connect the white wire from the solenoid to the F2 terminal on the starter/generator, and connect the ground wire from the frame to the A2 terminal on the starter/generator (**Figure 12-2, Page 12-3**). Install a flat washer, lockwasher, and nut onto each terminal and tighten the nut to 48 in-lb (5.4 N·m).
7. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

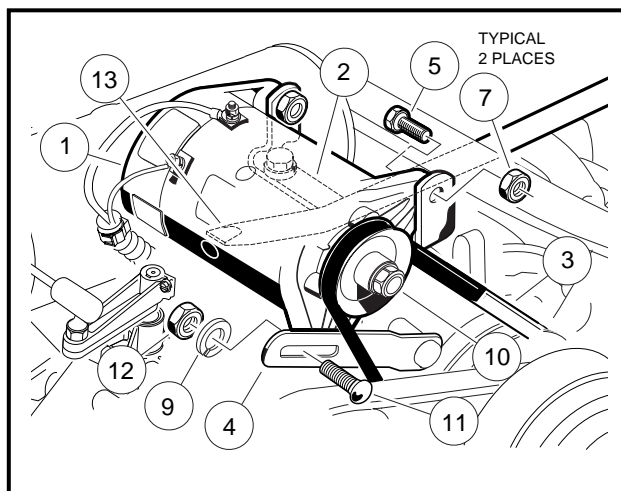


Figure 12-14 Starter/Generator Installation

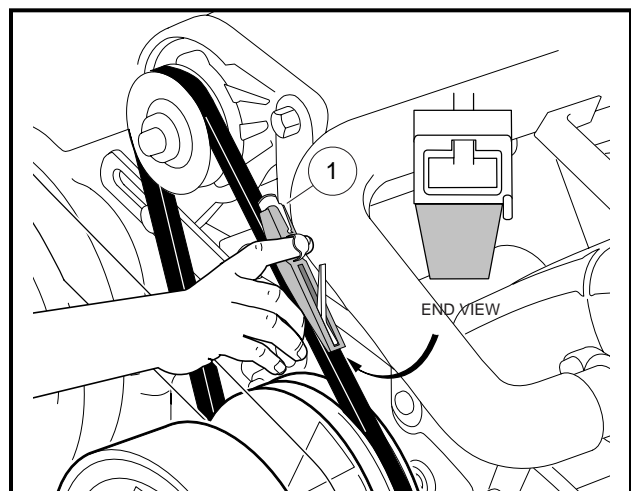


Figure 12-15 Belt Tension Gauge

Belt Tension Adjustment

Belt tension should be checked periodically. If the belt slips when starter/generator motor operates, adjust belt to correct tension.

1. Place the neutral lockout cam in the SERVICE position, put the Forward/Reverse handle in NEUTRAL, chock the wheels and disconnect the battery, negative cable first.
2. Remove the access panel on a DS Golf Car or Villager 4 vehicle; lift the cargo bed on a Turf or Carryall vehicle. **See WARNING on Page 12-1.**
3. Make sure the two pivoting screws (5) on the mounting bracket are finger tight. The carriage bolt (11) and hex nut (12) are to be finger tight also (**Figure 12-14, Page 12-11**).
4. Push the starter/generator down so it is at the lowest part of its adjustment travel. With the starter/generator belt fully in place around the drive clutch pulley, install the starter/generator belt (3) around the pulley (10) on the end of the starter/generator.
5. Position a pry bar (13) between the top of the starter/generator mounting bracket (2) and the underside of the starter/generator by passing the pry bar under the exhaust header.
6. While holding the pry bar, measure the belt tension using a Krikit[®] gauge (1) (available at NAPA[®] Auto Parts stores), or equivalent. Proper tension for a new starter/generator belt should be 75 ft-lb (101.7 N·m), or for an existing belt, 45 ft-lb (61 N·m) (**Figure 12-15, Page 12-11**).
7. While maintaining the tension, tighten the adjustment nut (12) to 12 ft-lb (16.3 N·m). Tighten the two pivot bolts (5) and hex nuts (7) to 23 ft-lb (31.2 N·m) (**Figure 12-14, Page 12-11**). **See following CAUTION.**

CAUTION

- REMOVE PRY BAR BEFORE STARTING ENGINE.

8. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

VOLTAGE REGULATOR

Read **DANGER** and **WARNING** on page 12-1.

Testing the Voltage Regulator

See Test Procedure 11, Section 11, Page 11-27.

Voltage Regulator Removal

1. Disconnect battery cables as shown (**Figure 12-1, Page 12-2**).
2. Remove the electrical component box cover and remove the wire tie securing the wires where they exit the component box.
3. Disconnect the voltage regulator red wire (1) at the large post on the solenoid and disconnect the yellow wire (2) at the bullet connector (**Figure 12-16, Page 12-13**).
4. Disconnect the voltage regulator black ground wire (3) at the battery frame ground and also from the normally open (NO) terminal of the kill limit switch in the component box (**Figure 12-16, Page 12-13**).
5. Remove the voltage regulator mounting screw (4) and remove the regulator (5).

Voltage Regulator Installation

1. Position the voltage regulator (5) in the electrical component box and install the mounting screw (4) (**Figure 12-16, Page 12-13**). Tighten screw to 23 in-lb (2.6 N·m).

2. Connect voltage regulator red wire (1) to the solenoid, and connect the yellow wire (2) bullet connector.
3. Connect the black ground wire (3) to the battery frame connection bolt (ring terminal) and also to the normally open (NO) terminal (slip on) of the kill limit switch (**Figure 12-16, Page 12-13**). Install a new wire tie.
4. Install snap-on electrical component box cover. Be sure to firmly press down all corners. Install screw.
5. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).
6. Place Forward/Reverse handle in NEUTRAL and place the neutral lockout cam in the SERVICE position. Start the engine and check regulator for proper functioning as described under voltage regulator testing. **See Test Procedure 11, Section 11, Page 11-27.**

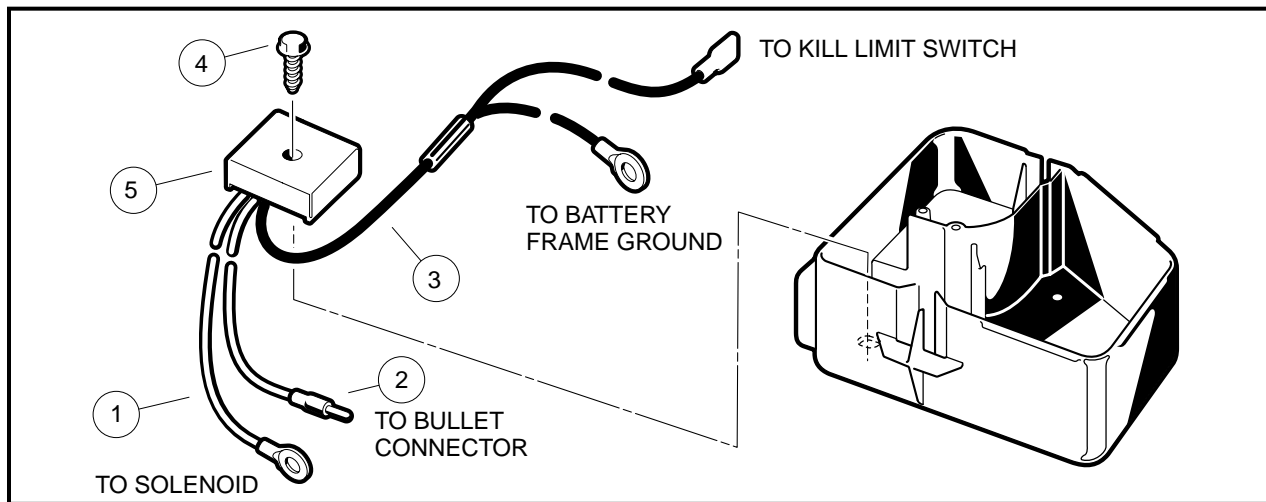


Figure 12-16 Voltage Regulator Installation

KEY SWITCH

Read **DANGER** and **WARNING** on page 12-1.

Testing the Key Switch

See Test Procedure 17, Section 11, Page 11-32 and Test Procedure 4, page 11-23.

Key Switch Removal

1. Disconnect battery cables as shown (**Figure 12-1, Page 12-2**).
2. Remove the center dash panel.
 - 2.1. Remove the plastic cap covering the screw on each side of the center dash.
 - 2.2. Loosen (but do not remove) the screw on each side of the center dash panel.
 - 2.3. Insert screwdriver at the top center of the dash between dash and cowl brace. Gently pry center dash out slightly from under edge of cowl brace.
 - 2.4. Pull center dash out approximately one inch from the frame and then bend the top right corner of the center dash inward while pulling the top of the panel out and down (**Figure 12-17, Page 12-14**).

NOTE

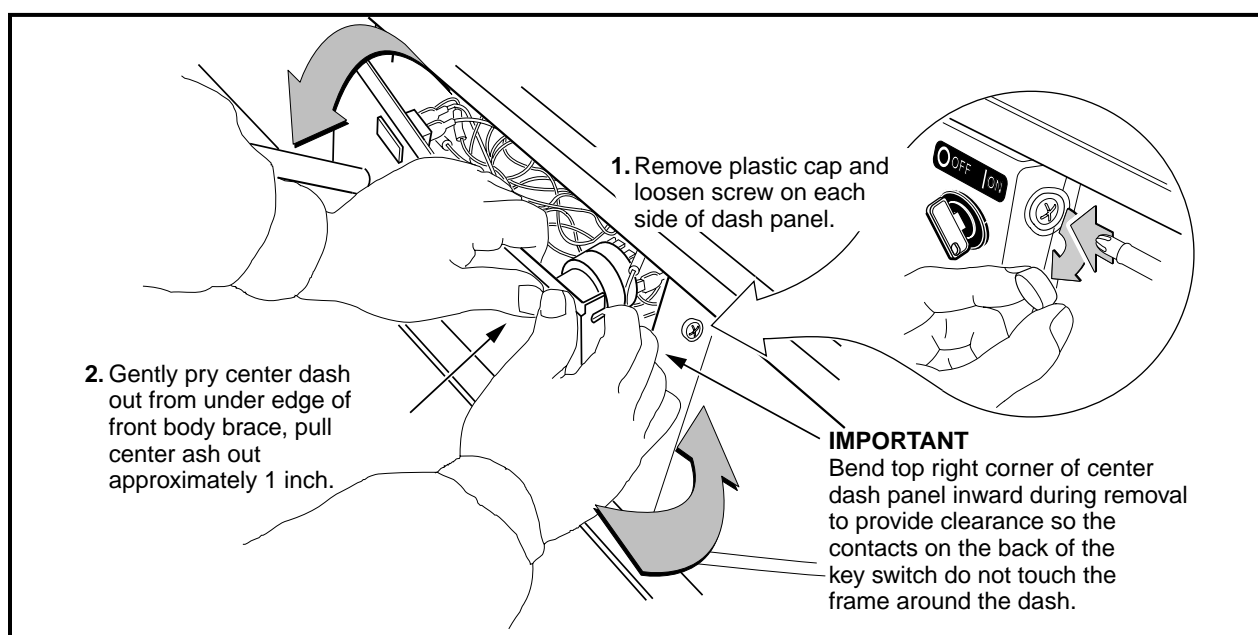
- BENDING THE TOP RIGHT CORNER OF THE CENTER DASH INWARD WHILE REMOVING IT WILL PREVENT THE CONTACTS ON THE REAR OF THE KEY SWITCH FROM TOUCHING THE METAL FRAME AROUND THE DASH.

Key Switch Removal, Continued:

- 2.5. Slide center dash panel up the steering column by snapping out the top and then rotating the panel out and up. There is sufficient slack in the wiring to allow for this.
3. Disconnect the wires from the key switch. Do not allow wires to touch.
4. Remove the key switch:
 - 4.1. Remove the key switch cap with a small, flat-blade screwdriver.
 - 4.2. Remove key switch from the dash by holding the key switch and turning the nut on the outside of the dash with a one-inch socket wrench. Remove the keyed washer with key switch.

Key Switch Installation

1. Reconnect wires to key switch. **See Section 11, Figure 11-2, Page 11-6.** Coat the connectors with Battery Protector Spray (Club Car Part No. 1014305) to prevent corrosion. Reverse removal procedures to install key switch in the dash. Be sure that key switch terminals cannot touch the frame and that panel is properly seated and snapped in place.

**Figure 12-17 Center Dash Removal**

2. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

SOLENOID

Read **DANGER** and **WARNING** on page 12-1.

Testing the Solenoid

See **Test Procedure 6, Section 11, Page 11-23.**

Solenoid Removal

1. Disconnect battery wires as shown (**Figure 12-1, Page 12-2**).
2. Remove electrical component box cover (**Figure 12-27, Page 12-24**).
3. Disconnect all the wires from the solenoid.
4. Remove the two screws that secure the solenoid in place, and remove the solenoid.

Solenoid Installation

1. Install the solenoid in the electrical component box. Use two screws to secure the solenoid to the box and tighten to 14 in-lb (1.6N·m).
2. Connect the 6 gauge white wire and the 16 gauge red wire from the voltage regulator on a large post on the solenoid. **See Section 11, Figure 11-2, Page 11-6.**
3. Connect the 18 gauge white wire from the Fuel/Hour Meter to the same large post.
4. Connect the 6 gauge red wire and the 10 gauge red wire from the fuse block on the other large post on the solenoid. **See Section 11, Figure 11-2, Page 11-6.**
5. Connect the 18 gauge blue wire from the key switch to a small post on the solenoid.
6. Connect the 18 gauge orange wire from the accelerator pedal limit switch to the other small post on the solenoid. **See Section 11, Figure 11-2, Page 11-6.**
7. Tighten the hex nuts on the large solenoid posts to 60 in-lb (6.7 N·m). Tighten the nuts on the small solenoid posts to 22 in-lb (2.5 N·m).
8. Install the snap-on electrical box cover by firmly pressing down on all corners and install the screw, tightening to 18 in-lb (2.0 N·m).
9. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

FUSE

Read DANGER and WARNING on page 12-1.

Testing the Fuse

See Test Procedure 1, Section 11, Page 11-18.

Fuse Removal

1. Disconnect battery cables as shown (**Figure 12-1, Page 12-2**).
2. Remove electrical component box cover.
3. Remove the fuse from the fuse block.

Fuse Installation

1. Install the fuse. Use a 10 amp fuse only.

WARNING

- IF THE FUSE IS BLOWN, DETERMINE THE CAUSE OF THE FAILURE AND MAKE NECESSARY REPAIRS BEFORE INSTALLING A NEW FUSE. USE 10 AMP FUSES ONLY; IF A FUSE WITH A HIGHER AMP RATING IS USED, DAMAGE TO THE VEHICLE ELECTRICAL SYSTEM MAY OCCUR.

2. Install the snap-on electrical box cover by firmly pressing down on all corners and install the screw, tightening to 18 in-lb (2.0 N·m).
3. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

ACCELERATOR PEDAL LIMIT SWITCH

Read **DANGER** and **WARNING** on page 12-1.

Testing the Accelerator Pedal Limit Switch

See Test Procedure 5, Section 11, Page 11-23.

Accelerator Pedal Limit Switch Removal

1. Disconnect battery wires as shown (**Figure 12-1, Page 12-2**).
2. Remove electrical component box cover (1) (**Figure 12-18, Page 12-17**).
3. Disconnect the green wire and the orange wire from the accelerator pedal limit switch (11) (**Figure 12-18, Page 12-17**).
4. Remove the two nuts (9) and washers (10) that secure the accelerator limit switch in place.
5. Remove the accelerator pedal limit switch.

Accelerator Pedal Limit Switch Installation

1. Install the accelerator pedal limit switch (11) onto the two screws (16) and secure the switch using two washers (10) and nuts (9). Torque to 5 in-lb (0.6 N·m) (**Figure 12-18, Page 12-17**).

WARNING

- DO NOT OVER-TIGHTEN THE RETAINING NUTS. IF THE NUTS ARE OVER-TORQUED, THE LIMIT SWITCHES COULD BE DAMAGED.

2. Connect the green wire to common (COM) terminal and the orange wire to the normally closed (NC) terminal of the accelerator pedal limit switch (**Figure 12-18, Page 12-17**).
3. Depress the accelerator pedal to make sure that the switch is being actuated when the pedal is released.
4. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

KILL LIMIT SWITCH

Read **DANGER** and **WARNING** on page 12-1.

Testing the Kill Limit Switch

See Test Procedure 16, Section 11, Page 11-31.

Kill Limit Switch Removal

1. Disconnect battery cables as shown (**Figure 12-1, Page 12-2**).
2. Remove electrical component box cover (1) (**Figure 12-18, Page 12-17**).
3. Remove the nuts (9) and washers (10) that secure the accelerator pedal limit switch (11). Do not disconnect the wires attached to this switch (**Figure 12-18, Page 12-17**).
4. Disconnect the two white/black wires and the black wire from the kill limit switch (12).
5. Remove the kill limit switch (12).

Kill Limit Switch Installation

1. Install the kill limit switch (12) onto the screws (16) (**Figure 12-18, Page 12-17**).
2. Connect the two white/black wires to the common (COM) terminal and the black wire to the normally open (NO) terminal of the kill limit switch (12).
3. Install the accelerator pedal limit switch (11) onto the screws (16). Secure the switch with washers (10) and nuts (9). Tighten to 5 in-lb (0.6 N·m).

⚠ WARNING

- DO NOT OVER-TIGHTEN THE RETAINING NUTS. IF THE NUTS ARE OVER-TORQUED, LIMIT SWITCHES COULD BE DAMAGED.

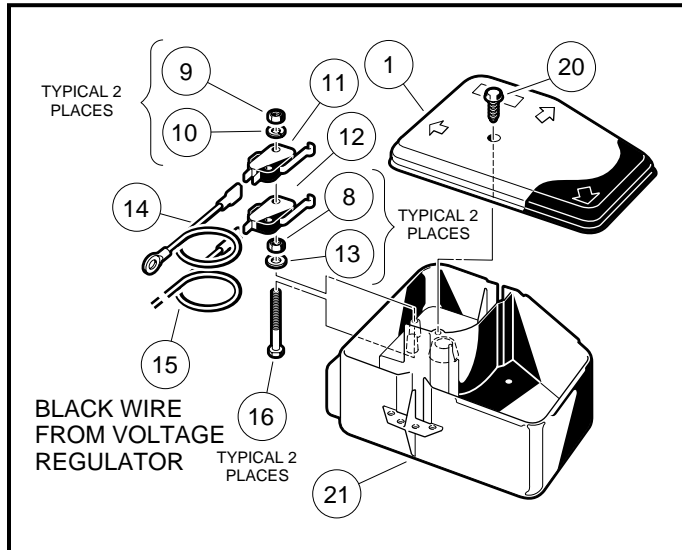


Figure 12-18 Accelerator Pedal and Kill Limit Switches

4. Depress and release the accelerator pedal to make sure that both switches are being actuated when the pedal is released.
5. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

NEUTRAL LOCKOUT LIMIT SWITCH

Read **DANGER** and **WARNING** on page 12-1.

Testing the Neutral Lockout Limit Switch

See Test Procedure 7, Section 11, Page 11-24.

Neutral Lockout Limit Switch Removal

1. Disconnect the battery cables as shown (**Figure 12-1, Page 12-2**).
2. Disconnect the green, white and black wires from the neutral lockout limit switch (5) located on the back of the Forward/Reverse shifter assembly (**Figure 12-19, Page 12-18**).
3. Remove the nuts (2) and washers (6) from the neutral lockout limit switch (5) and slide the neutral lockout limit switch off of the screws (**Figure 12-19, Page 12-18**).

Neutral Lockout Limit Switch Installation

1. Install the neutral lockout limit switch (5) with two washers (6) and nuts (2) (**Figure 12-19, Page 12-18**). Tighten to 5 in-lb (0.6 N·m). Place the Forward/Reverse handle in REVERSE to make sure that both switches actuate. **See following WARNING.**

⚠ WARNING

- DO NOT OVER-TIGHTEN THE RETAINING NUTS. IF THE NUTS ARE OVER-TORQUED, THE LIMIT SWITCHES COULD BE DAMAGED.

Neutral Lockout Limit Switch Installation, Continued:

2. Connect the black wire to common (COM) terminal, the green wire to the normally open (NO) terminal and the white wire to the normally closed (NC) terminal of the neutral lockout limit switch (**Figure 12-20**).
3. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).
4. Place the Forward/Reverse handle in NEUTRAL. The neutral lockout cam should be in the OPERATE position. Make sure everyone is clear of the vehicle. Turn the key switch ON. The engine should not crank when depressing the accelerator. If the engine does crank, turn the key switch OFF and re-adjust the shift linkage.
5. Test-drive the vehicle in both FORWARD and REVERSE for proper operation.

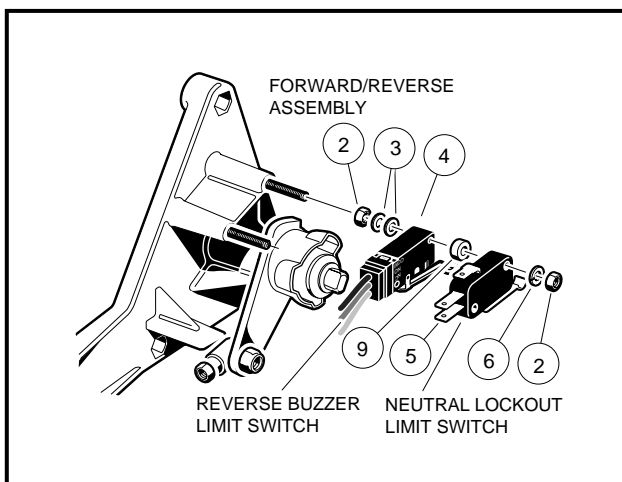


Figure 12-19 Forward/Reverse Limit Switches

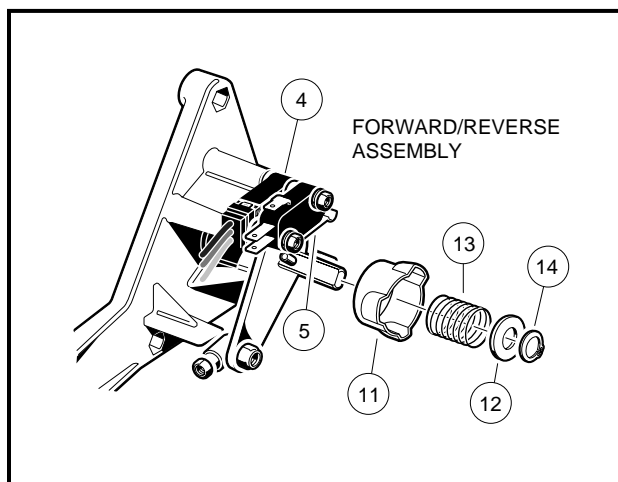


Figure 12-20 Neutral Lockout Cam

NEUTRAL LOCKOUT CAM

If the cam lobes have worn to the point where they will no longer actuate the neutral lockout limit switch, the cam must be replaced.

Testing the Neutral Lockout Cam

See Test Procedure 23, Section 11, Page 11-34.

Neutral Lockout Cam Removal

1. Disconnect the battery cables as shown (**Figure 12-1, Page 12-2**).
2. Remove the external snap ring (14) (**Figure 12-20, Page 12-18**).
3. Remove the plastic washer (12) and the spring (13).
4. Remove the cam (11).

Neutral Lockout Cam Installation

1. Install the cam (11) (**Figure 12-20, Page 12-18**).
2. Install the spring (13) and the plastic washer (12).
3. Install the external snap ring (14) onto the shaft. Be sure the snap ring is installed in the groove on the shaft.
4. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

REVERSE WARNING BUZZER

Read **DANGER** and **WARNING** on page 12-1.

Testing the Reverse Warning Buzzer

See Test Procedure 20, Section 11, Page 11-33.

Reverse Warning Buzzer Removal

1. Disconnect the battery cables as shown (**Figure 12-1, Page 12-2**).
2. Remove the center dash panel. **See Key Switch Removal, Page 12-13.**
3. Disconnect the wires from the reverse warning buzzer (3). Do not allow wires to touch (**Figure 12-21, Page 12-19**).
4. Remove reverse warning buzzer mounting screws (2) (**Figure 12-21, Page 12-19**).

Reverse Warning Buzzer Installation

1. Install the screws through the buzzer bracket tabs and tighten to 4 in-lb (0.45 N·m).
2. Connect black wire (4) from key switch to the negative (–) terminal on the buzzer (**Figure 12-21, Page 12-19**).
3. Connect the red/white wire (1) from the wire harness to the positive (+) terminal on the buzzer. (**Figure 12-21, Page 12-19**)
4. Reverse removal procedures to reinstall the center dash in the vehicle. Be sure that the key switch terminals cannot touch the frame and that the panel is properly seated and snapped in place.
5. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

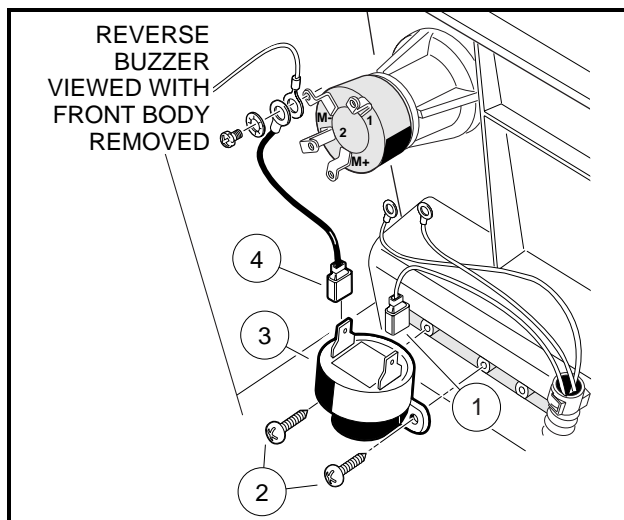


Figure 12-21 Reverse Buzzer

REVERSE BUZZER LIMIT SWITCH

Read **DANGER** and **WARNING** on page 12-1.

Testing the Reverse Buzzer Limit Switch

See Test Procedure 19, Section 11, Page 11-33.

Reverse Buzzer Limit Switch Removal

1. Disconnect the battery wires as shown (**Figure 12-1, Page 12-2**).
2. Disconnect the orange and red/white wires from the reverse buzzer limit switch (4) located on the back of the Forward/Reverse shifter assembly (**Figure 12-19, Page 12-18**).
3. Remove the two nuts (2) and washers (6) from the neutral lockout limit switch (5) then remove the neutral lockout limit switch. Do not disconnect the wires.
4. Remove the spacers (9) from the screws (4) and then remove the reverse buzzer limit switch.

Reverse Buzzer Limit Switch Installation

1. Install the reverse buzzer limit switch (4), and then install two spacers (9) (**Figure 12-19, Page 12-18**).
2. Install the neutral lockout limit switch (5), two washers (6) and two nuts (2). Torque to 4 in-lb (0.5 N·m).

⚠ WARNING

- DO NOT OVER-TIGHTEN THE RETAINING NUTS. IF THE NUTS ARE OVER-TORQUED, THE LIMIT SWITCHES COULD BE DAMAGED.

3. Place the Forward/Reverse handle in REVERSE and make sure that both switches actuate.
4. Connect the orange wire to the common (COM) terminal and the red/white wire to the normally open (NO) terminal of the reverse buzzer limit switch (4) (**Figure 12-19, Page 12-18**).
5. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).
6. Turn the key switch ON and shift the Forward/Reverse handle to REVERSE. The buzzer should sound.

OIL WARNING LIGHT

Read **DANGER** and **WARNING** on page 12-1.

Testing the Oil Warning Light

See Test Procedure 22, Section 11, Page 11-34.

Oil Warning Light Removal

1. Disconnect the battery wires as shown (**Figure 12-1, Page 12-2**).
2. Remove the center dash panel. See **Key Switch Removal, Page 12-13**.
3. Disconnect the wires from the oil warning light (11) (**Figure 12-22, Page 12-20**). Do not allow wires to touch.
4. Depress the two retaining tabs and remove the light from the center dash.

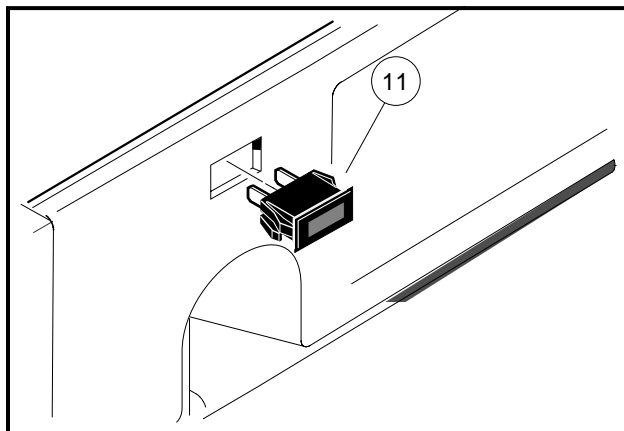


Figure 12-22 Oil Warning Light

Oil Warning Light Installation

1. Push a new unit into hole in dash until plastic tabs engage dash (**Figure 12-22, Page 12-20**).
2. Connect yellow wire from the key switch and yellow wire from the oil level sensor to the oil light.
3. Reinstall the center dash in reverse order of removal. Be sure that key switch terminals cannot touch the frame and that panel is properly seated and snapped in place.
4. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

FUEL/HOUR GAUGE

Read **DANGER** and **WARNING** on page 12-1.

Testing the Fuel/Hour Gauge

See **Test Procedures 26 and 27, Section 11, Page 11-36**.

With the key switch in the OFF position, the fuel/hour gauge fields are black. When the key switch is turned to ON, both fields activate. The fuel gauge initially registers *full* for a brief moment before indicating the actual fuel level.

The hour gauge displays the number of hours of use in increments of .1 hour, but does not record additional time unless the engine is running. When the hour gauge is recording, the hourglass icon at the left of the field blinks slowly.

Fuel/Hour Gauge Removal

1. Disconnect the battery wires as shown (**Figure 12-1, Page 12-2**).
2. Remove the center dash panel. See **Key Switch Removal, Page 12-13**.
3. Disconnect the wires from the fuel/hour gauge (**Figure 12-23, Page 12-21**). Do not allow wires to touch.
4. Remove the hex nuts and lockwashers from the studs on the back side of the gauge (**Figure 12-23, Page 12-21**). Remove the mounting bracket from the back side of the gauge and remove the gauge from the center dash.

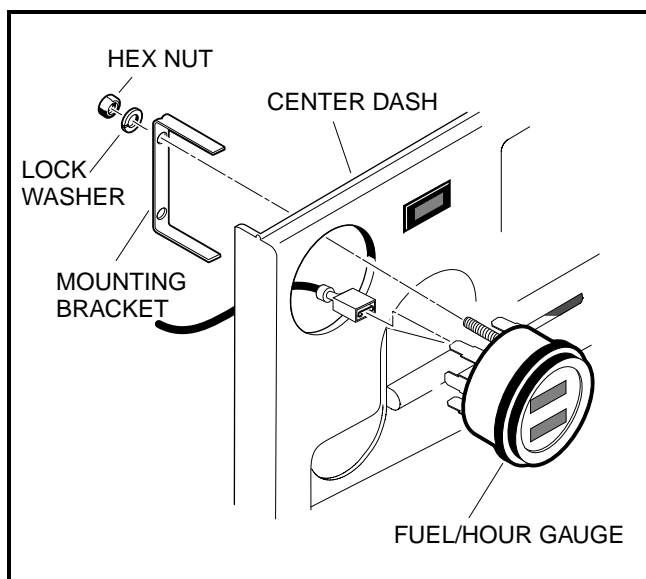


Figure 12-23 Fuel/Hour Gauge Installation

Fuel/Hour Gauge Installation

1. Install a new gauge into hole in dash. Be sure flange seats tightly against dash (**Figure 12-23, Page 12-21**).
2. Slide the mounting bracket onto the threaded studs on back of the fuel/hour gauge. Secure mounting bracket to the gauge with two lockwashers and hex nuts. Tighten hardware to 2.5 in-lb. (.28 N·m). Place one drop of Loctite™ on each hex nut. Do not allow Loctite to come into contact with the fuel/hour gauge casing.
3. Connect the blue wire from the key switch to the (2) terminal, the orange wire from the fuel level sending unit to the (1) terminal, the black wire from the frame ground to the (3) terminal, and the white wire from the solenoid to the (4) terminal.
4. Reinstall the center dash in reverse order of removal. Be sure that key switch terminals cannot touch the frame and that panel is properly seated and snapped in place.
5. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

FUEL LEVEL SENDING UNIT

Read **DANGER** and **WARNING** on page 12-1.

Testing the Fuel Level Sending Unit

See Section 11, Test Procedure 25, Page 11-35.

The fuel level sending unit is an integral part of the fuel tank and should never be removed. Thoroughly test the fuel level sending unit before replacing the fuel tank.

RPM LIMITER

Read **DANGER** and **WARNING** on page 12-1.

Testing the RPM Limiter

See Test Procedure 14, Section 11, Page 11-29.

RPM Limiter Removal

1. Disconnect the battery cables as shown (**Figure 12-1, Page 12-2**).
2. Disconnect the white/black wire from the black wire at the bullet connector located near the RPM limiter (2) (**Figure 12-24, Page 12-23**).
3. Disconnect the other black wire from the bullet connector near the RPM limiter.
4. Remove the two flange head bolts from the RPM limiter band and remove the RPM limiter and damper (**Figure 12-24, Page 12-23**).

RPM Limiter Installation

1. Place the RPM limiter damper on the front of the mounting bracket (**Figure 12-24, Page 12-23**).
2. Place the RPM limiter on the damper squarely so that limiter fits tightly against damper.
3. Place the band over the RPM limiter and align the holes. Install the brown wire with the ring connector onto the flange head bolt and secure the left side (driver side) of the band. Use another flange head bolt to secure the other side of the band. Make sure the band holds the RPM limiter securely in place.

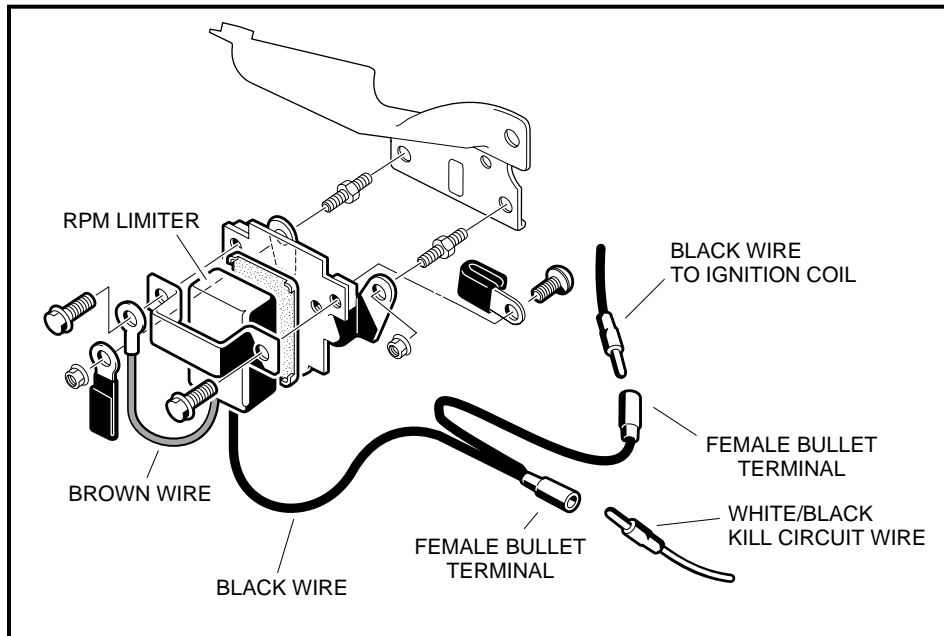


Figure 12-24 RPM Limiter Assembly

4. Mount the RPM limiter to the engine:
 - 4.1. Secure the extra wire with the clamp mounted on the back side of the RPM limiter mounting bracket (**Figure 12-24, Page 12-23**). Install the RPM limiter assembly onto the 2-ended bolts on the engine. Slide a wire clamp onto one of the bolts, then secure the limiter assembly with two M6 nuts and tighten to 50 in-lb (5.6 N·m) (**Figure 12-24, Page 12-23**).
5. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

IGNITION COIL

Read **DANGER** and **WARNING** on page 12-1.

Testing Ignition Coil

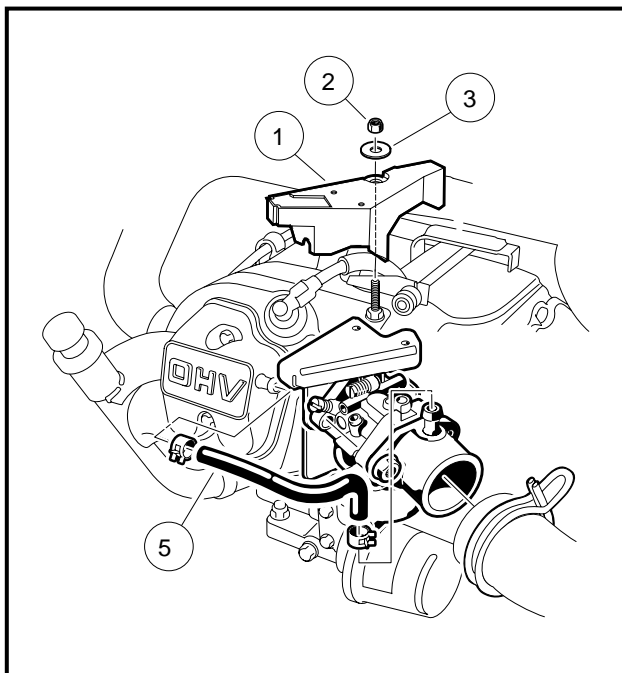
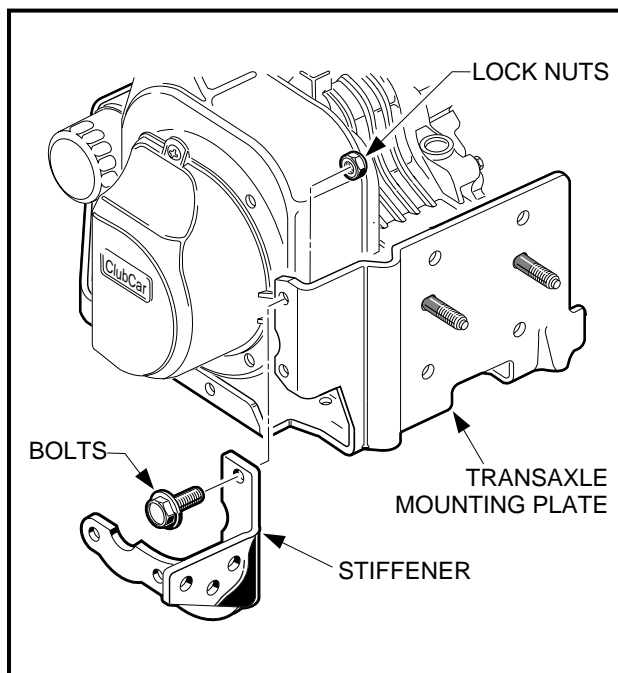
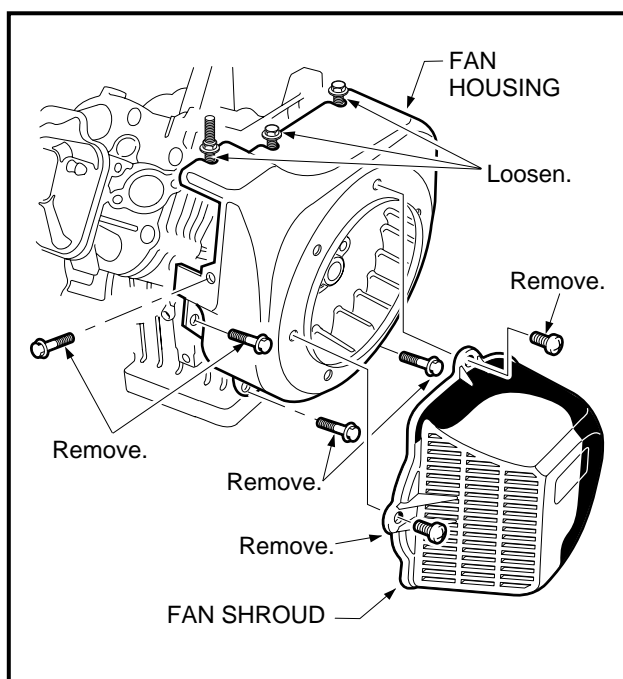
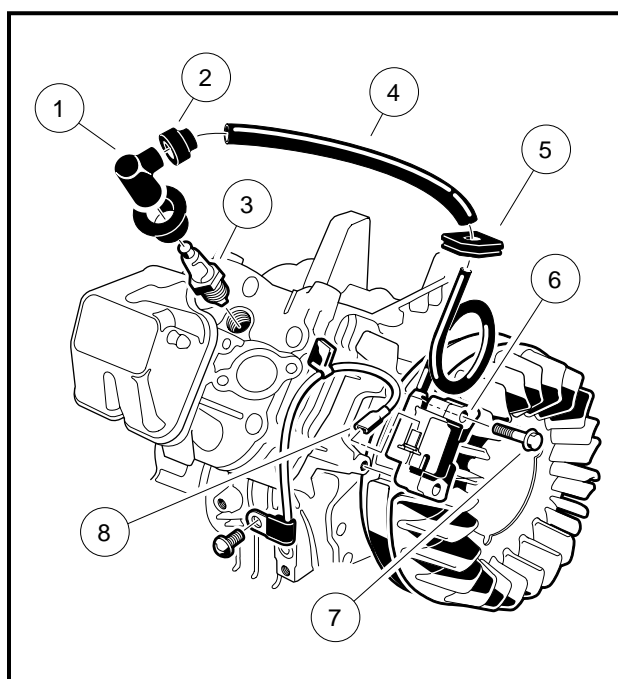
See Section 11, Test Procedure 13, Page 11-29, Test Procedure 14, Page 11-29 and Test Procedure 15, Page 11-30.

Ignition Coil Removal

1. Disconnect the battery cables, negative (–) first as shown (**Figure 12-1, Page 12-2**).
2. Disconnect the spark plug wire.
3. Remove the governor guard (1) (**Figure 12-25, Page 12-24**).
4. Remove the muffler. **See Section 15 – Exhaust System.**
5. Cut the tie wrap that holds the wire harness to the flywheel stiffener and remove the four hex head bolts securing the stiffener to the mounting plate (**Figure 12-26, Page 12-24**).
6. Remove the screws securing the fan shroud to the fan housing (**Figure 12-27, Page 12-24**).
7. Loosen but do not remove three screws attaching the fan housing as shown (**Figure 12-27, Page 12-24**).

Ignition Coil Removal, Continued:

8. Remove the remaining four screws attaching the fan housing as shown (**Figure 12-27, Page 12-24**), then while opening the housing, detach the spark plug wire grommet (5) from the housing and (**Figure 12-28, Page 12-24**).
9. Disconnect the 18 gauge black wire (8) from the spade terminal on ignition coil (6) and remove coil by removing two bolts (7) (**Figure 12-28, Page 12-24**).

**Figure 12-25 Governor Guard Removal****Figure 12-26 Stiffener Removal****Figure 12-27 Fan Housing and Shroud Installation****Figure 12-28 Coil Installation**

Ignition Coil Installation

NOTE

- IF A NEW IGNITION COIL IS BEING INSTALLED, THE SPARK PLUG CAP, GASKET, PROTECTOR TUBE AND GROMMET MUST BE REMOVED FROM THE OLD COIL AND INSTALLED ON THE NEW COIL. **SEE STEPS 1 THROUGH 8.**
- IF THE EXISTING IGNITION COIL WILL BE RE-INSTALLED, PROCEED TO STEP 9.

1. Remove the rubber gasket (2) on the plug cap by rolling back the gasket onto the spark plug wire.
2. Remove the cap (1) from the wire by rotating the cap counterclockwise three or four revolutions while gently pulling it off the wire (**Figure 12-28, Page 12-24**).
3. Remove the gasket (2) and protector tube (4) from the old coil.
4. Remove the grommet (5) from the old spark plug wire. Clean the grommet and place it on the new spark plug wire (**Figure 12-28, Page 12-24**). **See following NOTE.**

NOTE

- MOISTEN SPARK PLUG WIRE WITH WATER TO MAKE GASKET REMOVAL AND INSTALLATION EASIER.

5. Install protector tube (4) onto the new wire.
6. Slide the gasket (2) onto the end of the spark plug wire.
7. Install the cap onto the new coil by rotating it clockwise three or four revolutions while applying light pressure on the cap (**Figure 12-28, Page 12-24**).
8. Install the gasket (2) on the cap (1).
9. Position the ignition coil onto the cast mounting bosses on the engine crankcase, insert two mounting bolts and finger tighten.
10. Rotate the flywheel until the magnet is positioned directly under the coil. Use a .012 inch (0.304 mm) bronze feeler gauge to set the air gap between the coil and the flywheel magnet. Tighten the mounting bolts to 30 in-lb (3.4 N·m) (**Figure 12-29, Page 12-25**).
11. Connect the 18 gauge black wire to the spade terminal on the coil.

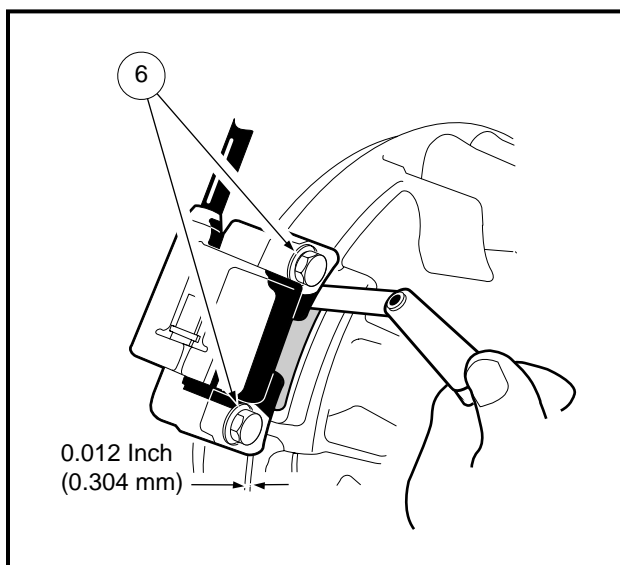


Figure 12-29 Set Air Gap

Ignition Coil Installation, Continued:

12. Position the fan housing close to the engine crankcase and install the plug wire grommet into the notch on the housing.
13. While installing fan housing, make sure the top front corner of the housing is above the upper cylinder shroud. The front edge of the fan housing should be behind the lower cylinder shroud. Align the slots in the housing with the flanged head bolts loosened earlier.
14. Install the four remaining flange bolts that secure the fan housing to the engine crankcase. Tighten all seven mounting bolts to 90 in-lb (10.1 N·m) **(Figure 12-27, Page 12-24)**.
15. Install the stiffener with four hex head bolts and locknuts. Tighten the hardware to 23 ft-lb (31.2 N·m) **(Figure 12-26, Page 12-24)**.
16. Tie wrap the wire harness to the stiffener. Insert tie wrap through the lower hole at the back of the stiffener.
17. Install the fan shroud with four pan head bolts. Tighten to 50 in-lb (5.7 N·m) **(Figure 12-27, Page 12-24)**.
18. Install the muffler. **See Section 15 – Exhaust System.**

⚠ CAUTION

- MAKE SURE WIRE HARNESS IS ROUTED AWAY FROM MUFFLER.

19. Place the governor guard (1) onto the throttle bracket and the 2-ended bolt. Install the two torx screws (4) through the governor guard into the throttle bracket and tighten to 15 in-lb (1.7 N·m). Place the 3/8 flat washer (3) onto the 2-ended bolt and secure with nylon locknut (2). Tighten the nut to 50 in-lb (5.7 N·m) **(Figure 12-25, Page 12-24)**.
20. Connect the spark plug wire to the spark plug.
21. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) **(Figure 12-1, Page 12-2)**. Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

OIL LEVEL SENSOR

Read DANGER and WARNING on page 12-1.

Testing the Oil Level Sensor

See Test Procedure 21, Section 11, Page 11-33.

Oil Level Sensor Removal

See Oil Level Sensor Removal, Section 13 – FE290 Engine, Page 13-24.

Oil Level Sensor Installation

See Oil Level Sensor Installation, Section 13 – FE290 Engine, Page 13-24.

BATTERY

Read DANGER and WARNING on page 12-1.

⚠ DANGER

- **DUE TO THE DANGER OF AN EXPLODING BATTERY, WEAR A FULL FACE SHIELD WHEN WORKING AROUND A BATTERY.**
- **BATTERY – EXPLOSIVE GASES! KEEP SPARKS, FLAMES, CIGARETTES AWAY FROM THE VEHICLE AND SERVICE AREA. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR EYE PROTECTION WHEN WORKING ON OR NEAR BATTERY. FOR ADDED PROTECTION, COVER TOP OF THE BATTERY WHEN SERVICING THE VEHICLE.**
- **BATTERY – POISON! CONTAINS ACID! CAUSES SEVERE BURNS – AVOID CONTACT WITH SKIN, EYES, OR CLOTHING.**
 - **EXTERNAL: FLUSH WITH WATER. CALL PHYSICIAN IMMEDIATELY.**
 - **INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL PHYSICIAN IMMEDIATELY.**
 - **EYES: FLUSH WITH WATER FOR 15 MINUTES. CALL PHYSICIAN IMMEDIATELY.**

General Information**See preceding DANGER statement.**

Club Car gasoline vehicles are equipped with 12-volt, low-maintenance batteries. When changing a 12-volt battery in any Club Car gasoline-powered vehicle, the same size battery with adequate amperage ratings should be used as a replacement.

Club Car recommends a group 70, side-post battery (Club Car Part No. 1012328), with a 615 cranking amp rating at 32 °F (0 °C) (500 CCA at 0 °F (-17.8 °C)) and a reserve capacity of at least 105 minutes. The group 70 classification indicates battery size (8-1/4 inch W x 6-1/2 inch D x 7-1/4 inch H). It is important to use the proper size to ensure that the battery clamp will fit correctly.

Testing the Battery

See Test Procedure 2, Section 11, Page 11-19.

Preventive Maintenance

To keep the battery in good operating condition, follow these steps on a regular basis.

1. Any corrosion build-up on or around the battery should be removed immediately. Post connections should be clean and tight. Any frayed or worn wires should be replaced. After all cables have been connected, coat terminals with Battery Protector Spray (Club Car Part No. 1014305) to prevent future corrosion.
2. The battery should be kept clean and dry to prevent self-discharge. Any dirt, grime or acid spillage should be removed. Wash the battery with a bristle brush using water and bicarbonate of soda (baking soda – 1 cup per gallon). Rinse with water. Do not allow solution to enter battery through the vent cap holes. **See Self-Discharge, Page 12- 28.**
3. Maintain proper water level. **See Water Level, Page 12- 28I.**
4. Check battery periodically to see that it is in a full state of charge. **See Charging the Battery, Page 12-29.**
5. Keep battery clamp tight. **See Vibration Damage, Page 12- 28.**

Self-Discharge

Dirt and battery acid can provide a path for a small current draw that slowly discharges the battery. To prevent self-discharge, the battery should always be kept clean.

Hot weather also has an effect on a battery's self-discharge rate. The higher the temperature, the quicker a battery will discharge. In hotter climates, therefore, the battery should be checked more often. When storing the battery, keep in a cool place. **See Battery Storage, Page 12-30.**

Water Level

The water level should be checked semi-annually to be sure water is at its proper level (**Figure 12-30, Page 12-28**). Never allow the water level to fall below the tops of the plates because this will cause the exposed part of the plate to become permanently inactive. Check the water level more frequently in hot weather or when the battery becomes old.

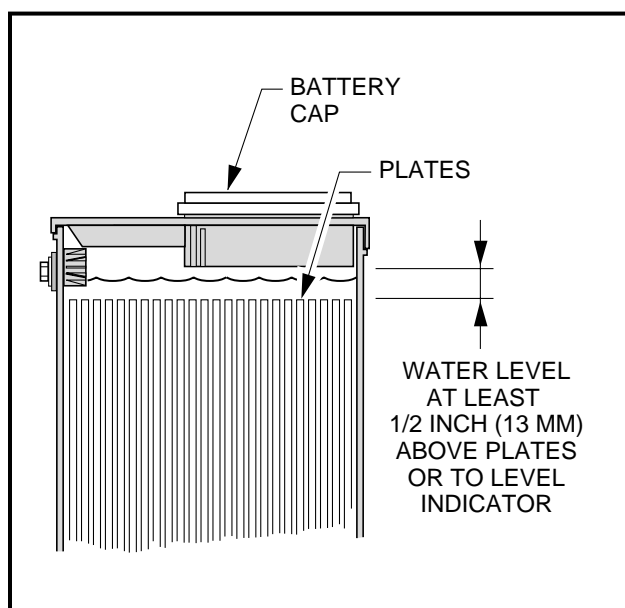


Figure 12-30 Battery Water Level

Vibration Damage

The battery clamp should always be tight enough to keep the battery from bouncing. Battery life may be severely shortened if the clamp is too loose. Excessive vibration shortens the life of the battery. It may also cause acid to leak out of the vent caps and corrosion to build up on surrounding metal parts. The acid which is lost reduces the capacity of the battery and cannot be replaced.

Mineral Content

For the longest battery life, distilled water should be used in the battery. However, if tap water is going to be used, contact your local water department to be sure mineral contents are below the levels listed in the following table. **See following NOTE.**

NOTE

- CONTACT YOUR LOCAL WATER DEPARTMENT FOR MINERAL CONTENT ANALYSIS.

IMPURITY	ALLOWABLE CONTENT IN PARTS PER MILLION
SUSPENDED MATTER	TRACE
TOTAL SOLIDS	100.0
CALCIUM AND MAGNESIUM OXIDES	40.0
IRON	5.0
AMMONIA	8.0
ORGANIC MATTER	50.0
NITRATES	10.0
NITRITES	5.0
CHLORIDE	5.0

Battery Removal

Read **DANGER** and **WARNING** on page 12-1 and **DANGER** on Page 12-26.

1. Disconnect the battery cables, negative (–) first as shown (**Figure 12-1, Page 12-2**).
2. Remove the clamp from the battery.
3. Lift the battery from the vehicle. **See following WARNING.**

WARNING

- KEEP THE BATTERY IN AN UPRIGHT POSITION TO PREVENT ELECTROLYTE LEAKAGE. TIPPING THE BATTERY BEYOND A 45° ANGLE IN ANY DIRECTION CAN ALLOW A SMALL AMOUNT OF ELECTROLYTE TO LEAK OUT THE VENT HOLE. DO NOT EXCEED THIS 45° ANGLE WHEN LIFTING, CARRYING OR INSTALLING BATTERY. THE BATTERY ACID COULD CAUSE SEVERE PERSONAL INJURY WHEN ACCIDENTALLY COMING IN CONTACT WITH THE SKIN OR EYES, AND COULD DAMAGE CLOTHING.

Charging the Battery

Read **DANGER** and **WARNING** on page 12-1 and **DANGER** on Page 12-26.

1. Charge the battery using an automotive type 12-volt battery charger. Follow all warnings and procedures supplied by the battery charger manufacturer.
2. Attach the positive charger cable (+) to the positive (+) battery post.
3. Attach the negative charger cable (–) to the negative (–) battery post.
4. The battery may be charged with a slow charge (3-10 amps) or a fast charge (20-30 amps). Charge until the specific gravity reaches 1.250. **See following WARNING.**

⚠ WARNING

- IF THE BATTERY CASE FEELS HOT – APPROXIMATELY 125 °F (51.7 °C) OR MORE – AND/OR EMITS GASES AND/OR FLUID BOILS FROM VENTS, STOP CHARGING AT ONCE. FAILURE TO STOP CHARGING BATTERY WHEN THESE CONDITIONS ARE PRESENT COULD RESULT IN AN EXPLOSION, PERSONAL INJURY AND/OR DAMAGE TO THE BATTERY.
- DO NOT DISCONNECT THE DC LEADS AND BATTERY WHEN THE CHARGER IS ON. THE RESULTING ARCING BETWEEN THE DC LEADS AND BATTERY POST COULD CAUSE AN EXPLOSION.
- IF THE CHARGER MUST BE STOPPED, DISCONNECT THE AC SUPPLY CORD FROM THE WALL OUTLET BEFORE DISCONNECTING THE DC LEADS FROM THE BATTERY. ALLOW THE BATTERY TO COOL TO ROOM TEMPERATURE AND RESUME CHARGING BATTERY AT A LOWER AMP RATE.

Battery Installation

Read DANGER and WARNING on page 12-1 and DANGER on Page 12-26.

1. Place the battery into the vehicle. Make sure the battery posts are facing the engine.
2. Secure the battery to the vehicle with the clamp. Install bolt, washer and locknut and tighten to 12 ft-lb (16.3 N·m).
3. Connect battery cables, positive cable first, and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 12-1, Page 12-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).

Battery Storage

Read DANGER and WARNING on page 12-1 and DANGER on Page 12-26.

1. Keep the battery clean and free of corrosion as outlined in Preventive Maintenance, Page 12-27.
2. The battery cables should be disconnected from the vehicle so it can be connected to the charger. The battery can be left in the vehicle.
3. Fully charge the battery prior to storage.
4. Store in a cool area. The colder the area in which the battery is stored, the less the battery will self-discharge. A battery stored at 0 °F (-17.8 °C) will discharge very little over a four-month period. A battery stored at 80 °F (27 °C) will have to be recharged every few weeks.
5. Check the state of charge periodically. A battery that is discharged and left in a cold environment can freeze and crack. If the specific gravity drops below 1.220, the battery should be recharged.

⚠ WARNING

- IF THE BATTERY IS FROZEN OR THE CONTAINER IS BULGED, DISCARD BATTERY. A FROZEN BATTERY CAN EXPLODE.

6. The frequency of recharging required depends on the temperature of the storage area, but it is recommended that the battery be monitored for state of charge every month. Also, if the storage area is unheated in a cold climate and recharging is required, it is recommended that the area be heated to at least 60 °F (15.6 °C) prior to charging. The battery will not charge effectively in cold temperatures for the same reasons that it does not discharge as rapidly in cold temperatures.

Charging a Dead Battery

Read **DANGER** and **WARNING** on page 12-1 and **DANGER** on Page 12-26.

The vehicle is equipped with a starter/generator. The generator is not designed to charge a dead battery. If the vehicle battery has become discharged, it must be charged using a properly rated automotive type charger.

WARNING

- DO NOT JUMP-START A DEAD BATTERY USING ANOTHER BATTERY AND JUMPER CABLES.

GROUND STRAPS

Read **DANGER** and **WARNING** on page 12-1.

Testing the Ground Straps

See Test Procedure 3, Section 11, Page 11-21.

SECTION 13 – FE290 ENGINE

DANGER

- **GASOLINE VAPORS – FLAMMABLE – DO NOT SMOKE! KEEP SPARKS, FLAMES, CIGARETTES AWAY FROM VEHICLE AND SERVICE AREA. TOOLS, WIRES AND METAL OBJECTS CAN CAUSE SPARKS WHEN “SHORTED” ACROSS A BATTERY. INSULATED TOOLS SHOULD BE USED. EXTREME CARE SHOULD BE TAKEN WHEN DISCONNECTING OR RECONNECTING THE BATTERY. WHEN WIRES ARE DISCONNECTED, BE SURE TO KEEP THEM AWAY FROM BATTERY TERMINALS AND OTHER WIRES. SERVICE ONLY IN WELL-VENTILATED AREAS.**
- **DO NOT OPERATE VEHICLE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. ENGINE PRODUCES CARBON MONOXIDE, WHICH IS AN ODORLESS, DEADLY POISON.**

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR. FOLLOW ALL PROCEDURES EXACTLY AND HEED ALL WARNINGS STATED IN THIS MANUAL.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY BEFORE SERVICING THE VEHICLE.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- FRAME GROUND – DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRIC WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR ANY OTHER METAL COMPONENT.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT THE BATTERY CABLES, NEGATIVE (–) FIRST AS SHOWN (**FIGURE 12-1, PAGE 12-2**).
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, SET THE PARK BRAKE WHEN LIFTING THE FRONT OF THE VEHICLE, UNLOAD THE CARGO BED AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. USE APPROVED JACK STANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.

GENERAL INFORMATION

Read DANGER and WARNING on page 13-1.

Club Car DS gasoline golf cars, Turf 1, Carryall 1, and Villager 4 vehicles are powered by 4-cycle, overhead valve, single cylinder, air-cooled engines. The 4-cycle engine has an oil reservoir (crankcase) similar to automobiles, trucks, aircraft, heavy equipment, machinery and other applications designed for reliable heavy-duty service. The engine has two major component assemblies: cylinder assembly and crankcase assembly.

NOTE

- ENGINE ROTATION IS CLOCKWISE AS VIEWED FROM THE CLUTCH SIDE OF THE ENGINE.

SPECIAL ENGINE SERVICE TOOLS AVAILABLE FROM CLUB CAR

DESCRIPTION	PART NUMBER
Gear Yoke	1016418
Compression Gauge and Adapter	101641001 and 02
Valve Spring Compressor	101641101
Valve Guide Reamer	101641201
Valve Guide Reamer Arbor	101641202
Piston Ring Compressor Kit	1016414
Piston Ring Pliers	1016415
Bearing Driver Set	1016416
Flywheel Puller Kit	1016627
Valve Clearance Adjuster Screw Holder	1016413
Bearing and Seal Remover Assembly	1016417
Valve Seat Cutter T Wrench	1016551
Valve Seat Cutter 45° x 32 mm Diameter (for FE290 engine only)	1016553
Valve Seat Cutter 30° and 45° x 35 mm Diameter	1016554
Valve Seat Cutter Guide	1016552

BEFORE SERVICING

To eliminate unnecessary work, carefully read the applicable information and instructions before beginning engine service. Diagrams, DANGER, WARNING, CAUTION and NOTE statements and detailed descriptions have been included wherever necessary. Nevertheless, even a detailed account has limitations. Therefore, anyone attempting engine service should have knowledge and experience in small engine service and repair.

MECHANICAL SYSTEMS**Adjustments**

All adjustments shall be made in accordance with **Section 10 – Periodic Maintenance**.

Edges**⚠ WARNING**

- WATCH FOR SHARP EDGES, ESPECIALLY DURING MAJOR ENGINE DISASSEMBLY AND ASSEMBLY. PROTECT YOUR HANDS WITH GLOVES OR A PIECE OF THICK CLOTH WHEN LIFTING THE ENGINE OR TURNING IT OVER.

Force

Common sense should dictate how much force is necessary for assembly and disassembly. If a part seems especially difficult to remove or install, stop and determine what may be causing the problem. Whenever tapping is necessary, tap lightly using a wooden or plastic-faced mallet. Use an impact driver for the removal of screws (particularly those held by a locking agent) in order to avoid damaging the heads.

Dirt

Clean the engine thoroughly before servicing it. **See following CAUTION.**

CAUTION

- BEFORE REMOVAL AND DISASSEMBLY, CLEAN THE ENGINE. ANY DIRT ENTERING THE ENGINE, CARBURETOR, OR OTHER PARTS WILL WORK AS AN ABRASIVE AND SHORTEN THE LIFE OF THE ENGINE. FOR THE SAME REASON, BEFORE INSTALLING A NEW PART, CLEAN OFF ANY DUST OR METAL FILINGS.

Tightening Sequence

Where there is a tightening sequence indicated in this Service Manual, the bolts, nuts, or screws must be tightened in the order and by the method indicated. When installing a part that is secured with several bolts, nuts, or screws, hand tighten all, then tighten to specified torque in the proper sequence. This is to avoid distortion of the part and/or causing gas or oil leakage. Conversely, when loosening the bolts, nuts or screws, loosen all about a quarter of a turn first and then remove them.

Torque

The torque values given in this Service Manual should always be adhered to. Applying too little or too much torque may lead to serious damage.

Lubricant

Some oils and greases should only be used in certain applications and may be harmful if used in an application for which they are not intended.

Lubrication

Engine wear is generally at its maximum while the engine is warming up and before all the rubbing surfaces have adequate lubrication. During assembly, oil or grease (whichever is more suitable) should be applied to any rubbing surface.

Press

A part installed using a press or driver, such as a seal, should first be coated with oil on its outer or inner circumference (contact surface) so that it will go into place smoothly.

Oil Seal, Grease Seal

During assembly use new oil or grease seals to replace any that were removed, as removal generally damages seals. To avoid damaging the seal lips, a seal guide is required for installation. Before a shaft passes through a seal, apply a small amount of lubricant (preferably high temperature grease) to the lip to reduce rubber-to-metal friction.

Gasket, O-Ring

When in doubt as to the condition of a gasket or O-ring, replace it with a new one. To avoid leaks, the mating surface around the gasket or O-rings should be free of foreign matter and perfectly smooth.

Liquid Gasket and Non-permanent Locking Agent

Follow manufacturer's directions for cleaning and preparing surfaces where these compounds will be used. Apply sparingly. Excessive amounts may block engine oil passages and cause serious damage.

Certain compounds can lead to premature gasket failure. Use the non-permanent locking agent Loctite®, Lock'n Seal (Blue) or approved equivalent.

Ball Bearing Installation

When installing a ball bearing, the bearing race which has a press fit should be pushed by a suitable driver. This prevents severe stress on the balls and races, and prevents damage. Press on the inner race if the ball bearing is being pressed onto a shaft, or on the outer race if the ball bearing is being pressed into a housing. Press the ball bearing until it is seated against the housing or on the shaft.

Circlip, Retaining Ring

Replace circlips and retaining rings that were removed with new circlips and retaining rings, as removal weakens and deforms them. During installation, take care to compress or expand them only enough for installation.

High Flash-point Solvent

To reduce fire danger a high flash-point solvent is recommended. A commercial solvent commonly available in North America is Stoddard solvent (generic name). Always follow manufacturer and container directions regarding the use of any solvent.

Molybdenum Disulfide (MoS₂) Grease

NOTE

- THIS MANUAL MAKES REFERENCE TO MOLYBDENUM DISULFIDE GREASE IN THE ASSEMBLY OF CERTAIN ENGINE AND CHASSIS PARTS. ALWAYS CHECK MANUFACTURER RECOMMENDATIONS BEFORE USING SUCH SPECIAL LUBRICANTS.

Engine Rotation

When turning the crankshaft by hand, always turn it **clockwise** as viewed from the clutch side of the engine. This will ensure proper adjustments.

ELECTRICAL SYSTEM

See also Section 11 – Troubleshooting and Electrical System and Section 12 – Electrical Components.

1. Always minimize shock hazards when working on electrical equipment. Work in a clean, dry environment with dry hands.
2. Electrical parts should never be struck sharply, as with a hammer, or allowed to fall on a hard surface. Such a shock can damage an electrical part.
3. Never replace a defective electrical component without first determining what caused the failure. If the failure was brought on by some other item or items, they too must be repaired or replaced before using the vehicle.
4. Make sure all connectors in the circuit are clean and tight, and examine wires for signs of overheating, fraying, etc. Wires in poor condition and bad connections will affect electrical system operation.
5. Measure coil and winding resistance when the part is cold (at room temperature).
6. All the electrical leads are either single-color or two-color and, with only a few exceptions, must be connected to leads of the same color. On any of the two-color leads, there is a greater amount of one color and a lesser amount of a second color, so a two-color lead is identified by first the primary color and then the secondary color. For example, a yellow wire with a thin red stripe is referred to as a "yellow/red" wire.

LUBRICATION SYSTEM

The engine is equipped with a pressurized lubrication system which consists of these components (Figure 13-1, Page 13-6) and (Figure 13-2, Page 13-6):

- Inlet filter screen (2)
- Trochoid pump (3)
- Cartridge filter (5)
- Pressure relief valve (8)

The pump (3) draws oil from the sump (1) and forces it under pressure into the crankcase passages as shown (**Figure 13-1, Page 13-6 and Figure 13-2, Page 13-6**). Oil can build up excess pressure in a lubrication system. To prevent build-up of excess oil pressure which could possibly force oil past the seals and damage the engine, the pump is fitted with a pressure relief valve (8) (**Figure 13-1, Page 13-6**) that is made of a ball and a spring. When the pressure increases beyond the pressure of the spring, the ball is forced off its seat against the spring pressure and excess oil is routed back into the sump (crankcase), thus relieving the pressure. When the pressure drops below the preset limit, the spring holds the ball against its seat to keep the oil from draining back into the sump (crankcase). Excess oil pressure could otherwise force the oil past seals and cause engine damage.

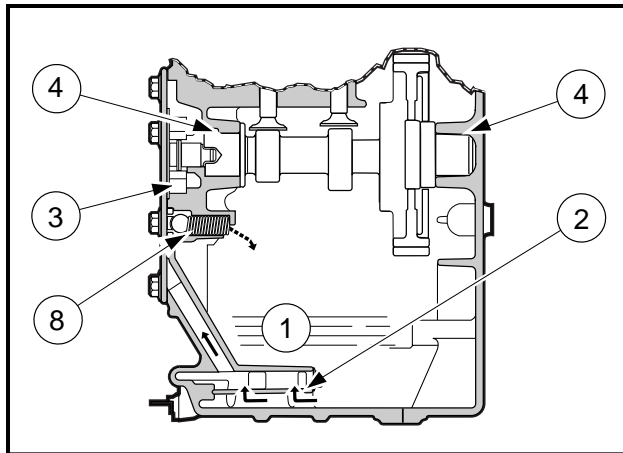


Figure 13-1 Cutaway View of Crankcase

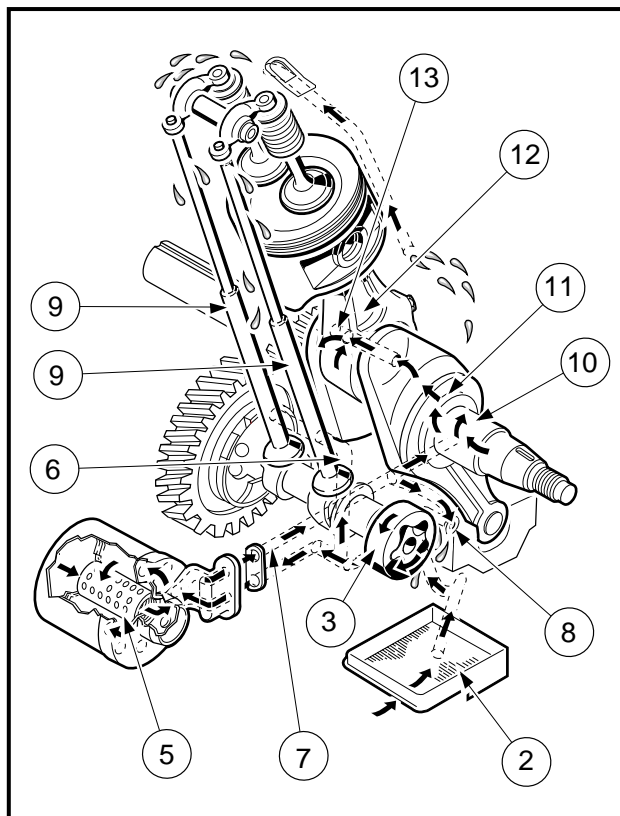


Figure 13-2 Lubrication System

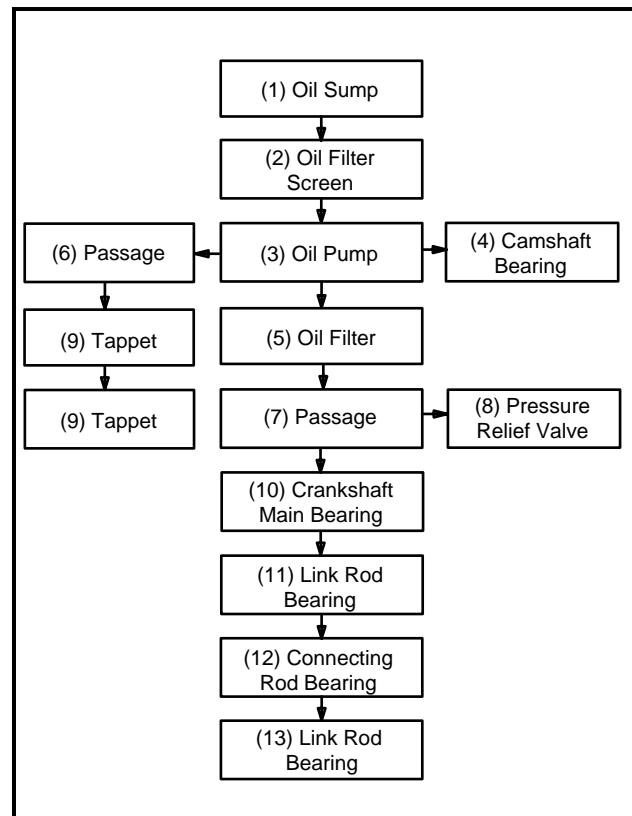


Figure 13-3 Lubrication System Flow Chart

SPARK PLUG

Spark plugs are selected to suit specific engine design and vehicle operating conditions. The spark plug (Club Car Part No. 101881101) is designed to give maximum life and efficient combustion of fuel. The spark gap is 0.027 - 0.031 inch (0.69 - 0.79 mm).

Spark Plug Removal

Read **DANGER** and **WARNING** on page 13-1.

CAUTION

- BEFORE REMOVAL AND DISASSEMBLY, CLEAN THE ENGINE.

Remove all dirt from plug base in the cylinder head before removing plug. Use a 13/16 deep well socket wrench or 13/16 plug wrench to loosen the plug.

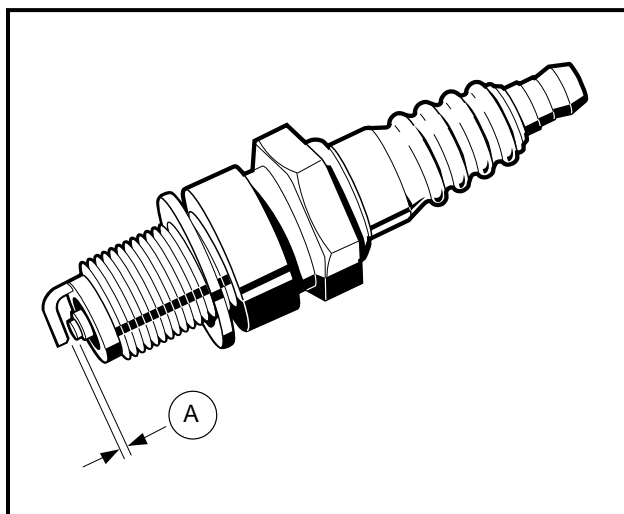


Figure 13-4 Spark Plug

Spark Plug Cleaning, Inspection and Repair

Examine the plug (**Figure 13-4, Page 13-7**). The deposits on the plug base and electrode are an indication of the correct heat range and efficiency as well as a guide to the general condition of the engine, fuel and air mixture and ignition system. If all of the above conditions are proper, the spark plug should be a light brown color. There should be no bridging between the electrode and base. The electrode should not be eroded. Black color, excessive carbon, and/or a wet plug indicate a too rich condition. White, burned or melted electrodes indicate a too lean condition or pre-ignition. Oily deposits on the plug electrode are an indication of worn rings, valve guides, cylinder wall, etc. Also examine the spark plug wire. Remove rubber boot and inspect internal spring for damage. Inspect spark plug wire for damage and be sure spring coil is securely attached to spark plug. **See following WARNING.**

WARNING

- REMOVE SPARK PLUG WIRE TO AVOID ACCIDENTAL START UP OF THE ENGINE WHEN SERVICING VEHICLE. TO AVOID IGNITION OF FUEL AND SERIOUS PERSONAL INJURY OR DEATH, NEVER TRY TO START THE ENGINE WITH PLUG REMOVED FROM ENGINE.

Testing the Spark Plug

Check the sparking ability of a cleaned and regapped plug on a sparking comparator if possible. Spark should be blue and strong and able to jump a 5/16 inch (8 mm) gap.

Setting the Spark Gap

1. Before setting the spark gap on a used plug, pass a contact point file between the electrodes to produce flat, parallel surfaces to facilitate accurate gauging.
2. Use a wire type gauge. Bend the outside or ground electrode so only a slight drag on the gauge is felt when passing it between the electrode. Never make an adjustment by bending the center electrode. Set gap (A) to 0.027 - 0.031 inch (0.69 - 0.79 mm) **(Figure 13-4, Page 13-7)**.

Spark Plug Installation

NOTE

- BEFORE INSTALLING THE PLUG, CHECK THE CONDITION OF THE THREADS IN THE CYLINDER HEAD. SOFTEN DEPOSITS IN CYLINDER HEAD THREADS WITH PENETRATING OIL AND CLEAN THE THREADS WITH A TAP IF NECESSARY.

1. Install the spark plug and thread it in until finger tight, then tighten the spark plug to 20 ft-lb (27 N·m).

ENGINE MOUNTING PLATE

See Engine Removal, Page 13-23.

CYLINDER HEAD

Read **DANGER** and **WARNING** on page 13-1.

GENERAL INFORMATION

Prior to attempting time-consuming repairs to the cylinder assembly, a cylinder compression test should be performed using a standard compression tester. Low compression would normally indicate a problem in the cylinder assembly such as defective rings, gaskets, etc. At a cranking speed of 550-600 rpm, the compression should be 156-185 psi.

CYLINDER SHROUD REMOVAL

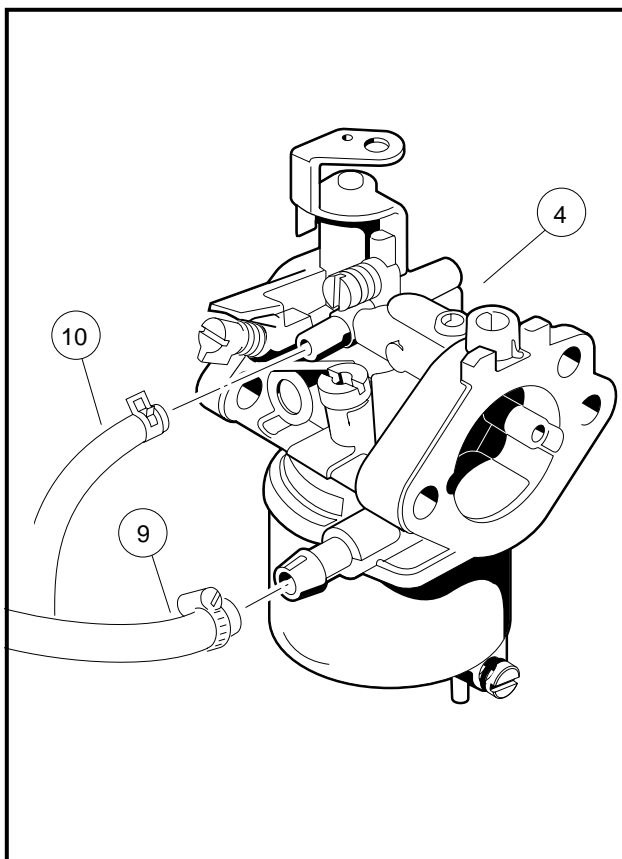
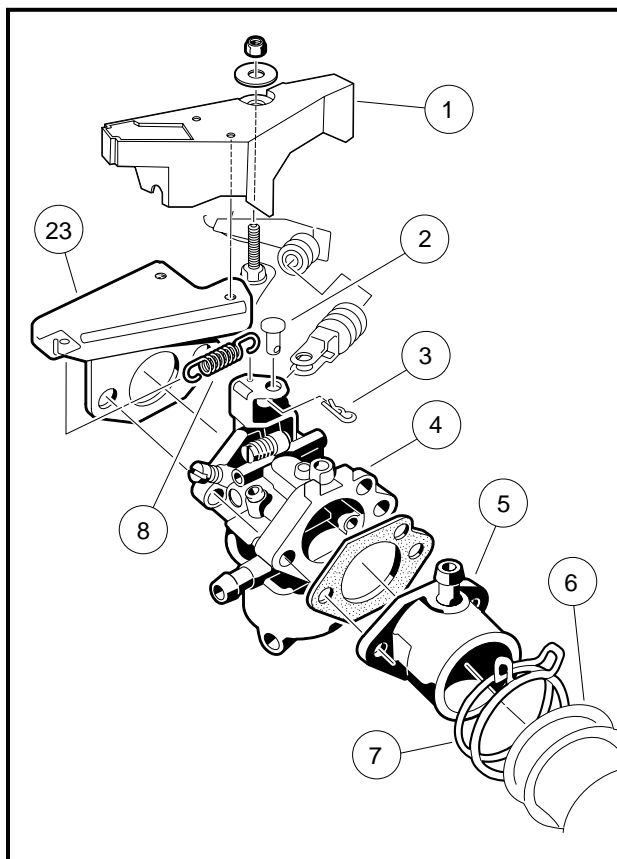
⚠ CAUTION

- BEFORE REMOVAL AND DISASSEMBLY, CLEAN THE ENGINE.

1. Access the engine compartment.
2. Remove spark plug wire from spark plug.
3. Loosen air intake hose clamp (7) from the intake pipe (5) and remove hose (6) **(Figure 13-6, Page 13-9)**.
4. Disconnect the fuel line (9) and vent tube(10) from the carburetor (4) **(Figure 13-5, Page 13-9)**.

Cylinder Shroud Removal, Continued:**⚠ WARNING**

- PLUG FUEL LINE TO PREVENT GAS FROM DRAINING FROM LINE.

**Figure 13-5 Carburetor****Figure 13-6 Carburetor Removal**

5. Remove governor guard (1) (**Figure 13-6, Page 13-9**).
6. Remove cotter pin (3) and clevis pin (2) from throttle lever (**Figure 13-6, Page 13-9**).
7. Remove nuts at carburetor intake pipe (5) and remove intake pipe (**Figure 13-6, Page 13-9**). See following **CAUTION**.

⚠ CAUTION

- DISCONNECT THE GOVERNOR LINKAGE FROM THE CARBURETOR BEFORE ATTEMPTING TO REMOVE THE CARBURETOR. FAILURE TO DO SO COULD DAMAGE THE LINKAGE.

8. Remove carburetor (4) along with throttle spring (8) and throttle spring bracket (23) (**Figure 13-6, Page 13-9**).
9. Remove muffler. **See Section 15 – Exhaust System.**
10. If the engine is to be totally disassembled, drain oil and remove the oil filter. If only the cylinder head is to be disassembled, proceed without draining the oil or removing the oil filter.

11. Disconnect oil filler tube (20) from cylinder shroud by first removing the locknut (18), ground wire (17) and flange nut (10) and then pulling oil filler tube out of the crankcase cover (**Figure 13-8, Page 13-10**).

NOTE

- MAKE SURE VEHICLE IS LEVEL BEFORE REMOVING FILLER TUBE. THIS WILL PREVENT OIL FROM SPILLING WHEN FILLER TUBE IS REMOVED.

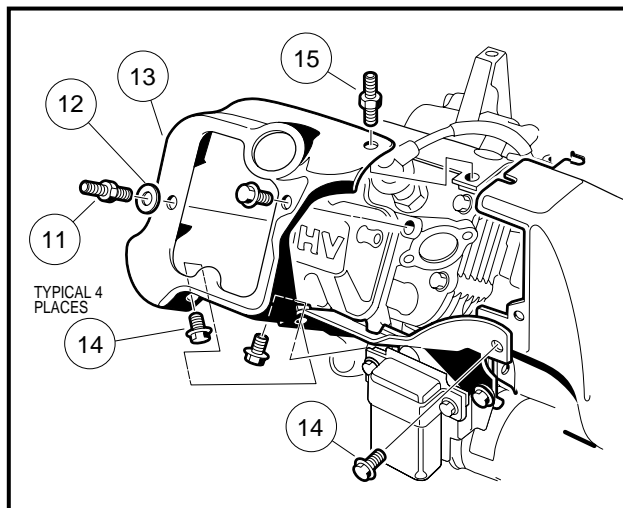


Figure 13-7 Head Shroud Removal

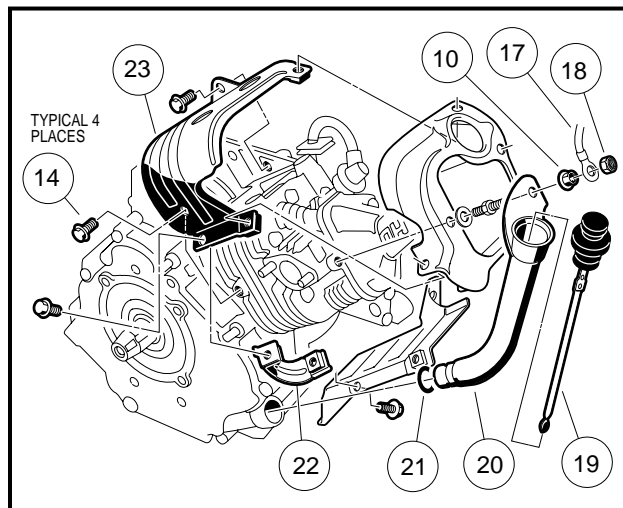


Figure 13-8 Upper Shroud and Oil Filler Removal

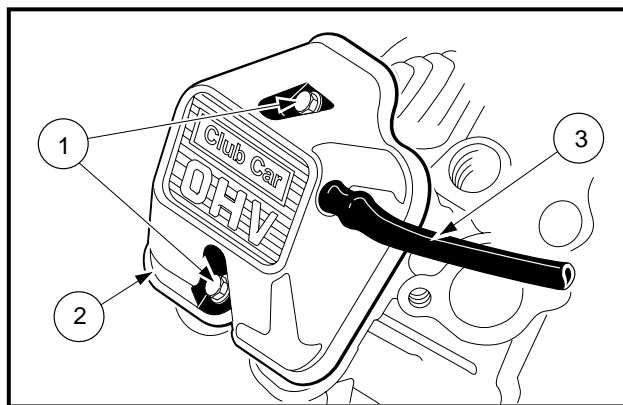


Figure 13-9 Rocker Cover Removal

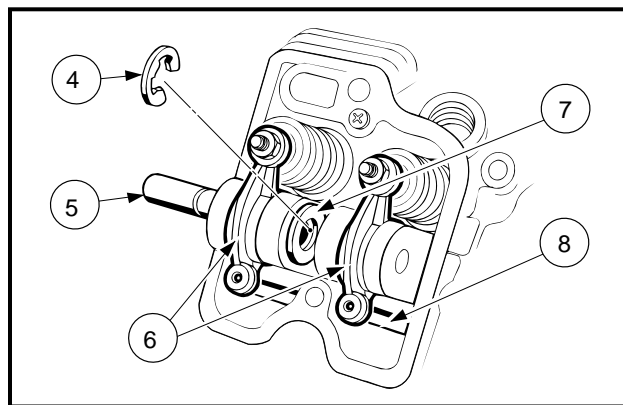


Figure 13-10 Rocker Shaft Removal

12. Remove the eight bolts (14) and the two-ended bolts (11 and 15) (**Figures 13-7 and 13-8, Page 13-10**).
13. Take off the head shroud (13), the upper shroud (23) and the bracket (22) (**Figures 13-7 and 13-8, Page 13-10**).

ROCKER ARM AND PUSH ROD REMOVAL

1. Remove the two bolts (1) and remove the rocker cover (2) along with breather tube (3) (**Figure 13-9, Page 13-10**). See following NOTE.

NOTE

- MARK THE ROCKER ARMS (6) AND THE PUSH RODS (8) SO THEY CAN BE PUT BACK IN THEIR ORIGINAL POSITIONS (**FIGURE 13-10, PAGE 13-10**).

Rocker Arm and Push Rod Removal, Continued:

2. Remove the E-ring (4) and pull the rocker shaft (5) out of the cylinder head (**Figure 13-10, Page 13-10**).
3. Lift out the rocker arms (6), washer (7), and push rods (8) (**Figure 13-10, Page 13-10**).

CYLINDER HEAD REMOVAL

1. Remove the six bolts (1) and remove the cylinder head assembly (2) (**Figure 13-11, Page 13-11**).
2. Remove head gasket (3). Note the position of the two dowels (4) as shown (**Figure 13-12, Page 13-11**).

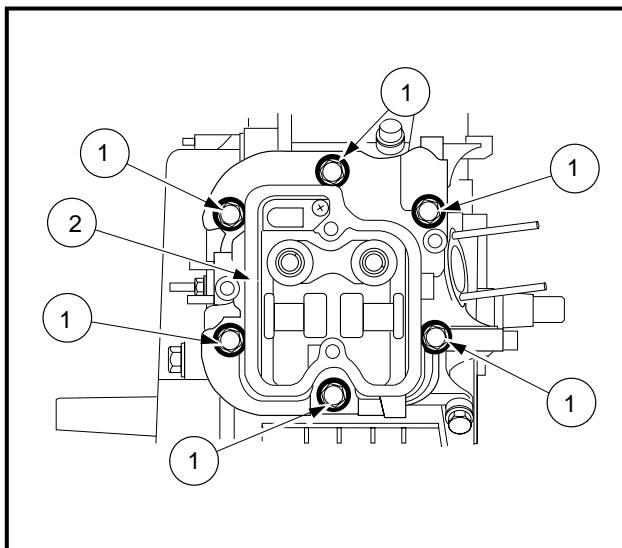


Figure 13-11 Cylinder Head

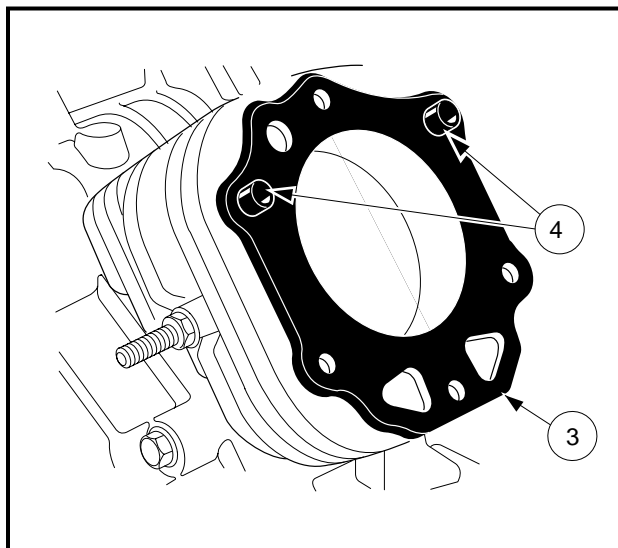


Figure 13-12 Head Gasket

VALVE REMOVAL

1. Compress the valve spring with the valve spring compressor (5) (Club Car Part No. 101641101) and remove the collet halves (6) (**Figure 13-13, Page 13-12**).
2. Remove spring compressor, and take out the upper retainer (7) and the spring (8).
3. Remove valve (10).
4. Remove valve stem seal (11) with a screwdriver (**Figure 13-14, Page 13-12**). See following **CAUTION**.

⚠ CAUTION

- TO KEEP THE SCREWDRIVER FROM DAMAGING THE CYLINDER HEAD FLANGE SURFACE, PLACE A PIECE OF HEAVY CARDBOARD OR WOOD BETWEEN THEM (**FIGURE 13-14, PAGE 13-12**).
- THE VALVE STEM SEAL CANNOT BE REUSED. REPLACE VALVE STEM SEAL WITH A NEW ONE.

5. Remove spring seat (9) (**Figure 13-14, Page 13-12**).

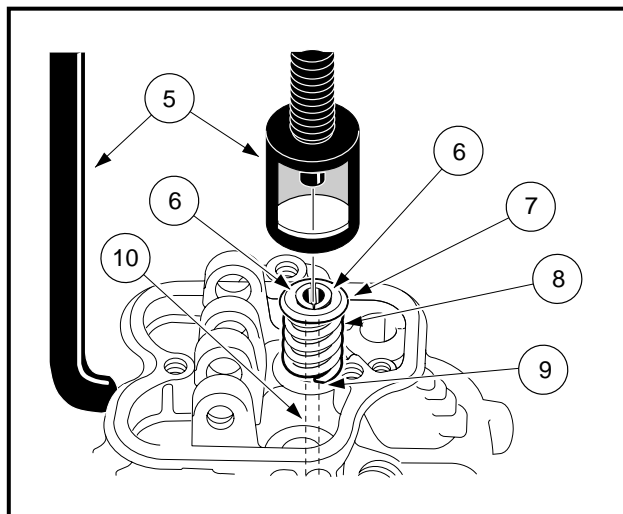


Figure 13-13 Valve Removal

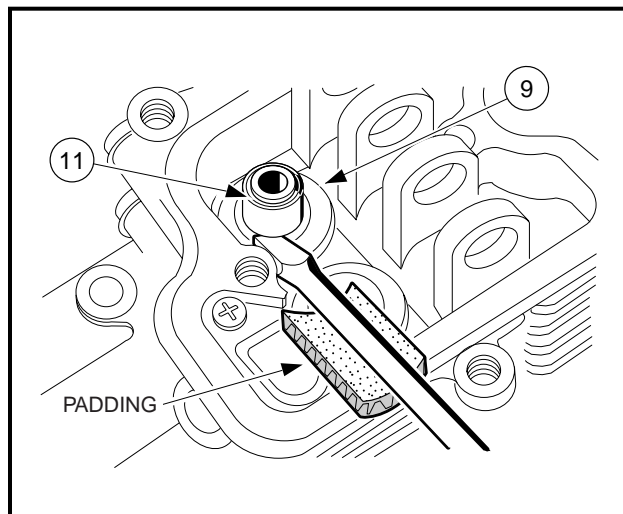


Figure 13-14 Spring Seat Removal

BREATHER VALVE (REED VALVE)

General Information

The function of the breather is to create a vacuum in the crankcase which prevents oil from being forced out of the engine through the piston rings, oil seals or gaskets.

The breather has a reed valve which limits the direction of air flow caused by the piston moving up and down. Air can flow out of the crankcase, but the one-way reed valve blocks return flow. It thus maintains a vacuum in the crankcase.

Oil laden air in the crankcase passes through the reed valve and expands into the rocker chamber. In the rocker chamber most oil separates from the air and drains back to the crankcase. The air passes through a tube and vents to the intake manifold.

Breather Valve (Reed Valve) Removal

1. Unscrew the mounting screw (1) and remove the back plate (2) and reed valve (3) (**Figure 13-15, Page 13-12**). See **Page 13-21** for Installation.

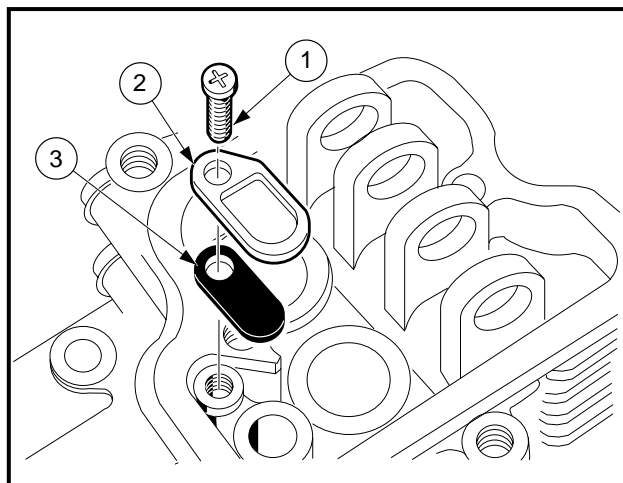


Figure 13-15 Reed Valve

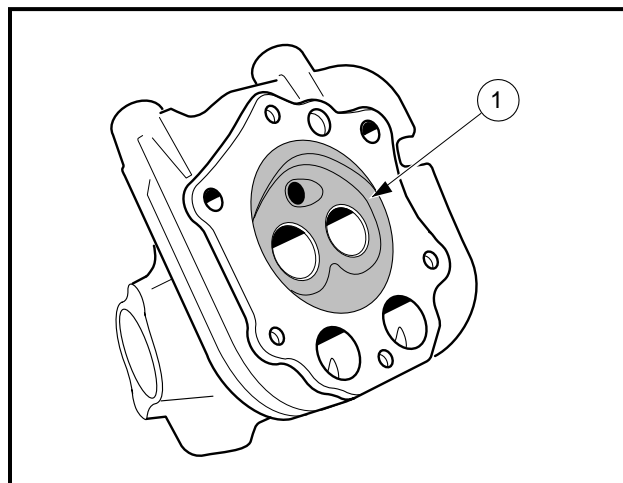


Figure 13-16 Combustion Chamber

CYLINDER HEAD CLEANING AND INSPECTION

1. Clean the head with a non-flammable solvent and dry thoroughly.
2. Bead blast or scrape carbon deposits from head. When scraping carbon deposits, be careful to avoid scratching or nicking the cylinder head.
3. Inspect the spark plug port threads for damage. If threads are damaged, replace the head.
4. Place the cylinder head on a surface plate (**Figure 13-17, Page 13-13**).
5. Measure the space between the surface plate and the head with a feeler gauge (1) to check the flatness of the head surface (**Figure 13-17, Page 13-13**).
6. If the head is warped more than 0.002 inch (0.05 mm), replace the head. **See following CAUTION.**

⚠ CAUTION

- SMOOTH OUT ANY DAMAGED SPOTS IN THE COMBUSTION CHAMBER (1) USING A SMALL GRINDER. SHARP EDGES IN THE COMBUSTION CHAMBER MAY CAUSE PRE-IGNITION. DO NOT REMOVE ANY MORE MATERIAL THAN IS NECESSARY OR CHANGE THE SHAPE OF THE COMBUSTION CHAMBER (**FIGURE 13-16, PAGE 13-12**).
- DO NOT GRIND THE VALVE SEATS OR THE GASKET SURFACE.

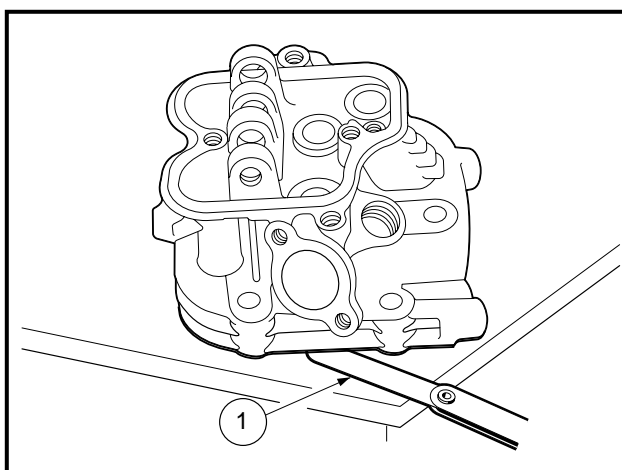


Figure 13-17 Check Flatness of Head Surface

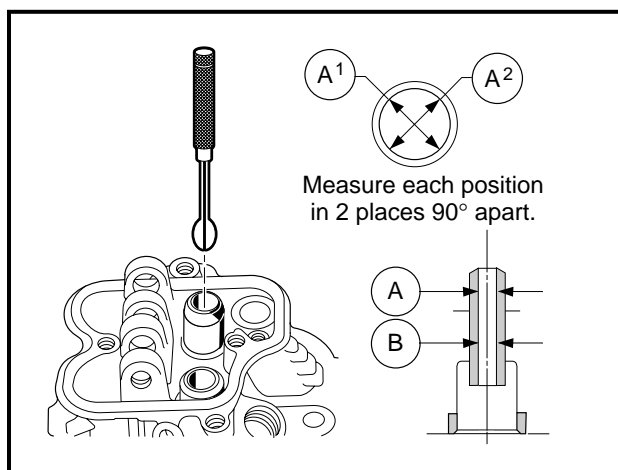


Figure 13-18 Measure I.D. of Valve Guides

VALVE GUIDES

Valve Guide Inspection

1. Measure the inside diameter of each guide with a telescoping gauge (**Figure 13-18, Page 13-13**).
2. If the inside diameter exceeds 0.2781 inch (7.065 mm), replace the guide.

Valve Guide Replacement

1. With the combustion chamber side of the head facing up, drive the guide out of the head with a valve guide arbor (1) (Club Car Part No. 101641202) (**Figure 13-19, Page 13-14**).
2. Install the snap ring (2) on the new valve guide (**Figure 13-20, Page 13-14**).
3. Coat the guide with a light film of clean engine oil.

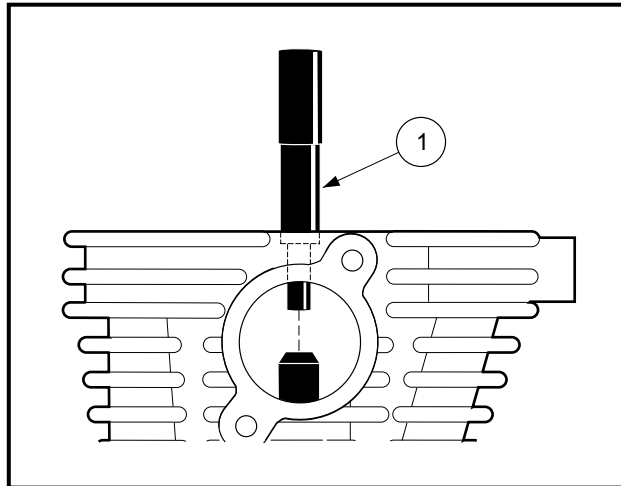


Figure 13-19 Valve Guide Removal

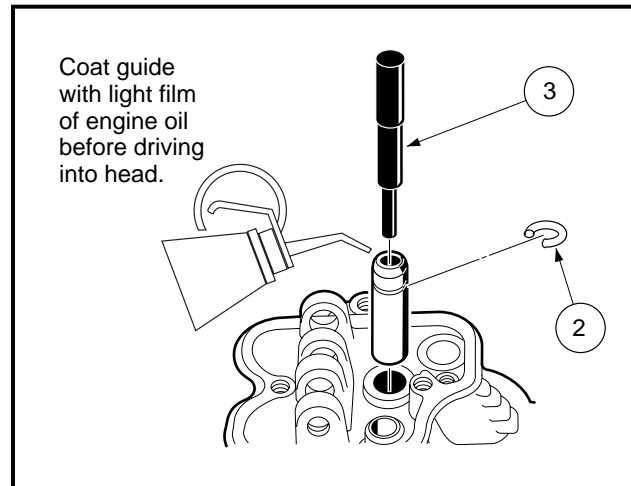


Figure 13-20 Valve Guide Installation

4. With the rocker arm side of the head facing up, drive the new valve guide into the head with the valve guide arbor (3) until the snap ring (2) just seats on the head (**Figure 13-20, Page 13-14**).
5. Ream the guide with a stanisol or kerosene lubricant and a valve guide reamer (Club Car Part No. 101641201). The valve guide inside diameter should be 0.2756 - 0.2762 inch (7.000 - 7.015 mm) (**Figure 13-21, Page 13-14**).

VALVE SEATS

Read **DANGER** and **WARNING** on page 13-1.

Valve Seat Inspection

1. Inspect the valve seats for damage. If the seats are warped or distorted beyond reconditioning, replace the cylinder head.
2. Using Prussian Blue, coat the valve seat.
3. Push the valve into the guide.
4. Rotate the valve against the seat with a lapping tool (1) (**Figure 13-22, Page 13-14**).

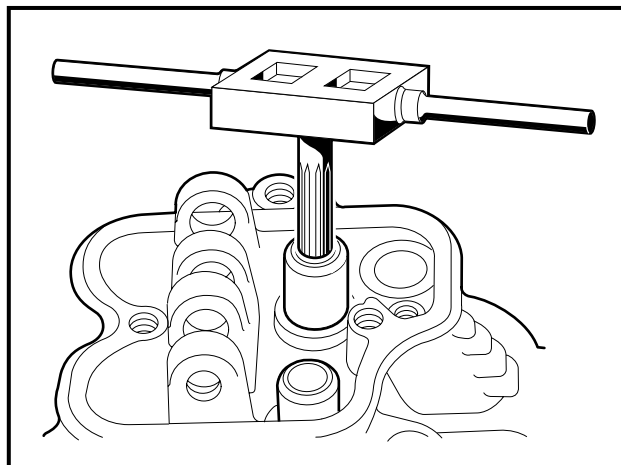


Figure 13-21 Ream Valve Guide

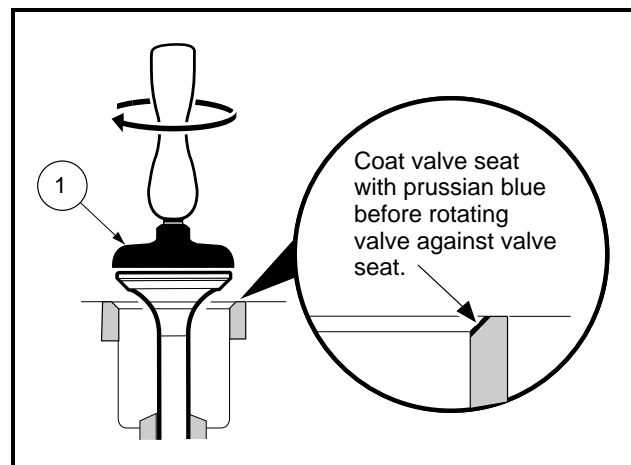


Figure 13-22 Rotate Valve against Valve Seat

Valve Seat Inspection, Continued:

5. Pull the valve out, and check the mark on the valve head. It must be 0.0197 - 0.0433 inch (.50 - 1.10 mm) in width, and even all the way around the seat and valve (**Figure 13-23, Page 13-15**).

NOTE

- THE VALVE STEM AND GUIDE MUST BE IN GOOD CONDITION OR STEP 5 WILL NOT BE VALID.

6. If the valve seating surface is not correct, repair the seat.
7. Pitted or worn valve seats can be resurfaced. **See Valve Seat Repair.** Make sure to lap the valves to the seats after refacing.

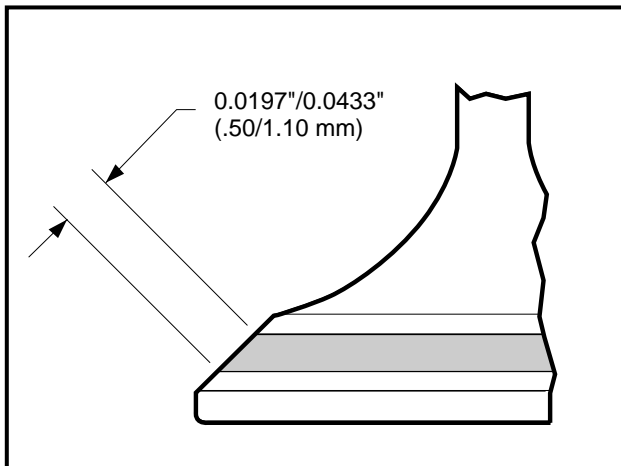


Figure 13-23 Check Mark on Valve Head

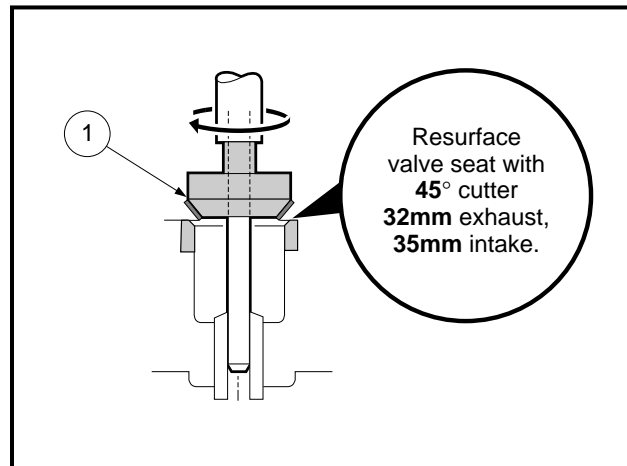


Figure 13-24 Recondition Valve Seat

Valve Seat Repair**⚠ CAUTION**

- IF YOU ARE UNFAMILIAR WITH THE FOLLOWING PROCEDURES, CLUB CAR SUGGESTS THAT THE CYLINDER HEAD BE TAKEN TO A PROFESSIONAL ENGINE MACHINE SHOP FOR RECONDITIONING.

1. Clean the cylinder head thoroughly. **See Cylinder Head Cleaning, Page 13-13.**
2. Recondition the valve seats with the valve seat cutters (45° x 32 mm Exhaust Seat, 45° x 35 mm Intake Seat).
 - 2.1. Using Prussian Blue, check the seats for good contact all the way around. **See Valve Seat Inspection, Page 13-14.**
 - 2.2. Measure the seat width of the 45° angle portion of the seat at several places around the seat (**Figure 13-25, Page 13-16**).
 - 2.3. If the seat width is more than 0.079 inch (2.0 mm), the seating surface should be resurfaced.
 - 2.4. Resurface the valve seat with a 45° cutter (1) (32mm Exhaust Valve Seat Cutter, Club Car Part No. 1016553, and 35mm Intake Valve Seat Cutter, Club Car Part No. 1016554), removing only enough material to produce a smooth and concentric seat (**Figure 13-24, Page 13-15**). **See following CAUTION.**

⚠ CAUTION

- USE CARE NOT TO DULL THE CUTTER. DO NOT TURN THE CUTTER COUNTERCLOCKWISE OR ALLOW IT TO HIT A METAL OBJECT.

- 2.5. Use a 30° x 35mm seat cutter (1) (Club Car Part No. 1016554) to narrow the seat width to the standard width (**Figure 13-24, Page 13-15**). See following **CAUTION** and **NOTE**.
- 2.6. Turn the seat cutter (1) clockwise one turn at a time while pressing down very lightly. Recheck the width after each cutter revolution (**Figure 13-24, Page 13-15**). See following **CAUTION** and **NOTE**.

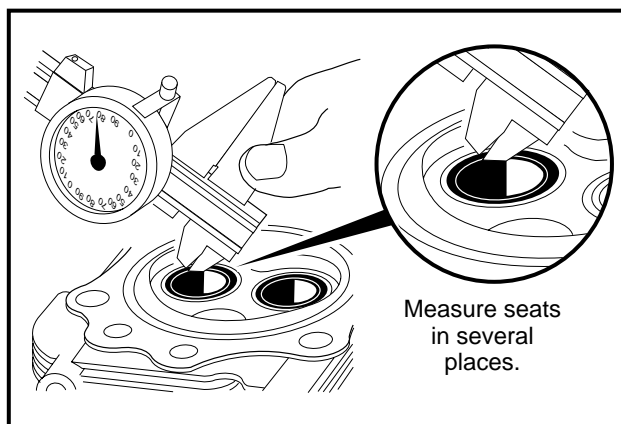
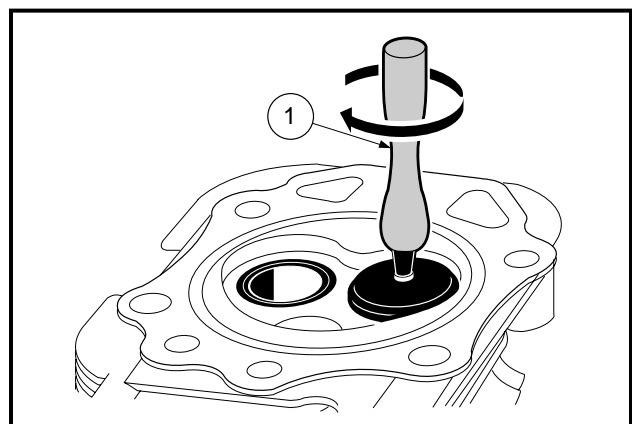
⚠ CAUTION

- THE 30° X 35MM SEAT CUTTER REMOVES MATERIAL VERY QUICKLY. CHECK THE SEAT OUTSIDE DIAMETER FREQUENTLY TO PREVENT OVER-CUTTING.

NOTE

- KEEP THE SEAT WIDTH AS CLOSE AS POSSIBLE TO 0.031 INCH (0.8 MM).

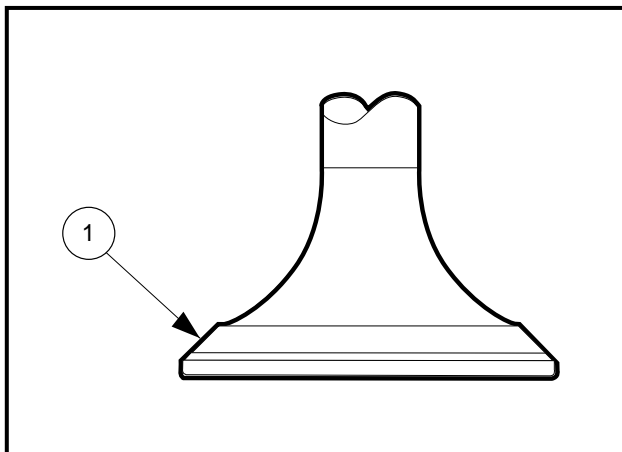
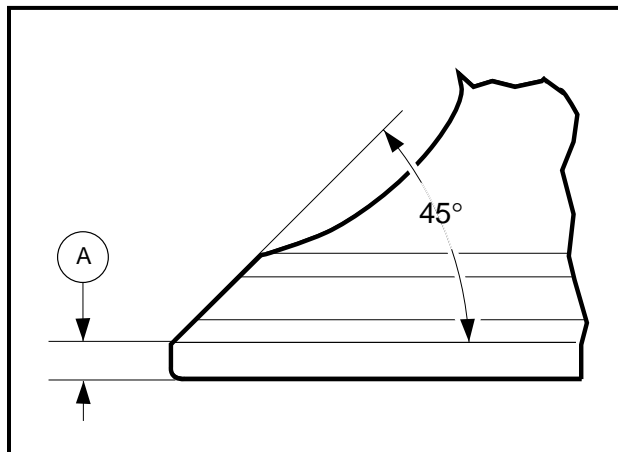
- 2.7. Make a light pass with the 45° cutter (1) (32mm Exhaust Valve Seat Cutter, Club Car Part No. 1016553), and 35mm Intake Valve Seat Cutter (Club Car Part No. 1016554) to remove any possible burrs at the edge of the seat.
3. After applying a coat of Prussian Blue to the valve face, insert the valve, and snap it closed against the seat several times. The valve surface should show good contact all the way around. Be sure the valve seat is centered on the valve face. The position of the valve in the seat is evident after lapping the valve.
4. If the seat does not make proper contact, lap the valve into the seat with a vacuum cup tool.
- 4.1. Coat the surface of the valve sparingly with a fine lapping compound.

**Figure 13-25 Measure Seat Width****Figure 13-26 Lap Valve to Seat**

- 4.2. Use the vacuum cup lapping tool (1) to grip the top of the valve. Rotate the valve in a circular motion to lap the valve to the seat (**Figure 13-26, Page 13-16**).
- 4.3. Lift the valve slightly from the seat every 8 to 10 strokes, continuing the lapping operation until a uniform ring appears around the entire surface of the valve face.
5. When lapping is completed, wash all parts in solvent to remove lapping compound. Dry the parts thoroughly.

Valve Seat Repair, Continued:

6. Note the position of the lapping mark on the valve face. The lapping mark should appear on or near the center of the face.
7. When the engine is assembled, be sure to adjust the valve clearance. **See Valve Clearance Adjustment, Page 13-21.**

**Figure 13-27 Valve Head Seating Area****Figure 13-28 Valve Seating Surface Area****VALVES****Visual Inspection**

1. Inspect the valve head seating area (1) for erosion, nicks and warping, etc. **(Figure 13-27, Page 13-17).**
2. If the valve head seating area is worn, replace the valve.
3. If the valve head seating area is eroded or nicked, it may be possible to repair the valve on a valve refacing machine. Follow the refacing machine manufacturer's instructions. The valve seating surface angle for the FE290 engine is 45° **(Figure 13-28, Page 13-17).**
4. Inspect the stem for obvious wear, discoloration, and stem end damage.
5. If the stem is obviously worn or discolored, replace the valve.

Valve Head Thickness

1. Measure the thickness of the valve head, as shown **(Figure 13-28, Page 13-17).**
2. If the valve head thickness (A) **(Figure 13-28, Page 13-17)** is less than 0.024 inch (0.610 mm), replace the valve.

Valve Stem Bend

1. Support the valve in V-blocks at each end of the stem **(Figure 13-29, Page 13-18).**
2. Position a dial gauge perpendicular to the stem.
3. Turn the valve and read the variation on the dial gauge.
4. If stem bend is greater than the service limit of 0.0012 inch (0.0305 mm), replace the valve.

Valve Stem Diameter

1. Using a micrometer, measure the diameter of the stem at several points along its length **(Figure 13-30, Page 13-18).**
2. If the outside diameter is less than the service limit of 0.2728 inch (6.930 mm) intake, 0.2722 inch (6.915 mm) exhaust, replace the valve.

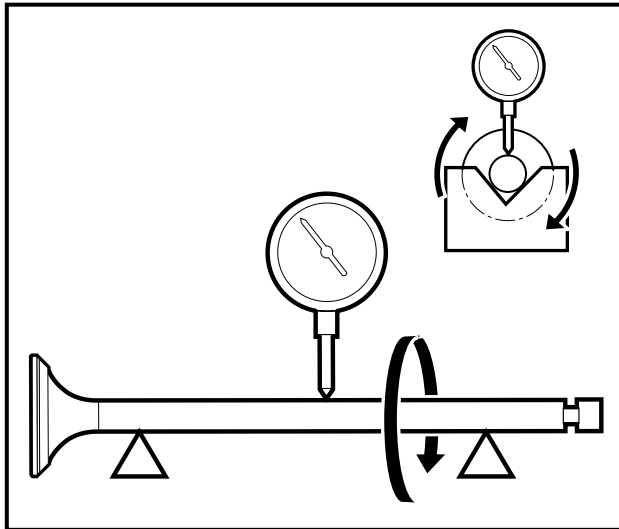


Figure 13-29 Measure Valve Stem Bend

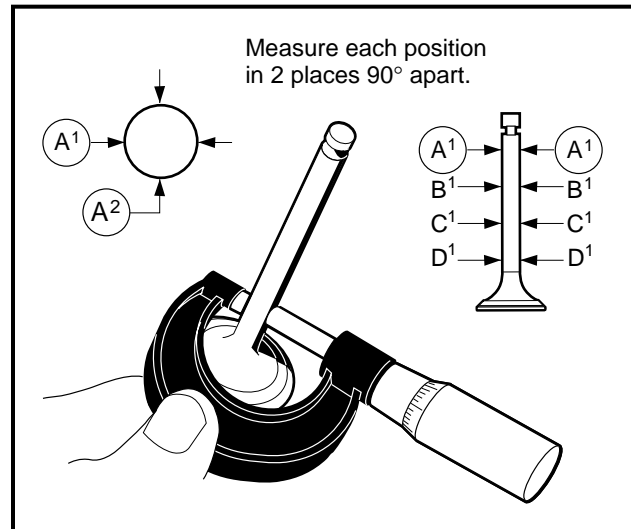


Figure 13-30 Measure Valve Stem Diameter

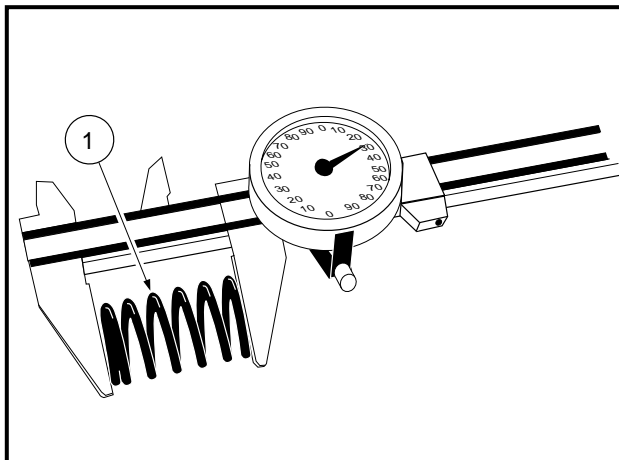


Figure 13-31 Measure Free Length of Spring

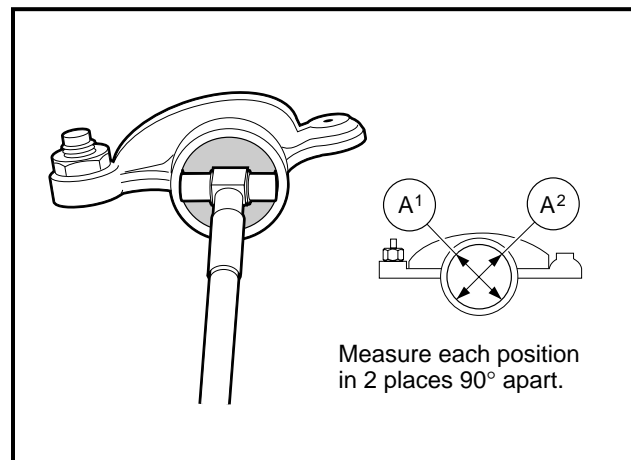


Figure 13-32 Measure I.D. of Rocker Arm Bearing

Valve Spring Inspection

1. Inspect the valve springs (1) for pitting, cracks, corrosion, and burrs. Replace the springs if necessary (**Figure 13-31**).
2. Measure the free length of the spring. If the measurement is less than the service limit of 1.29 inch (32.77 mm), replace the spring (**Figure 13-31, Page 13-18**).

Valve Installation

1. Valve installation is the reverse of removal. **See Page 13-11 and following NOTE.**

NOTE

- VALVE SPRING COILS ARE CLOSER TOGETHER (HAVE A NARROWER PITCH) AT ONE END OF THE SPRING THAN AT THE OTHER. **SEE FIGURE 13-35, PAGE 13-19.** INSTALL SPRINGS WITH THE NARROW PITCH ENDS ON THE SPRING SEATS.

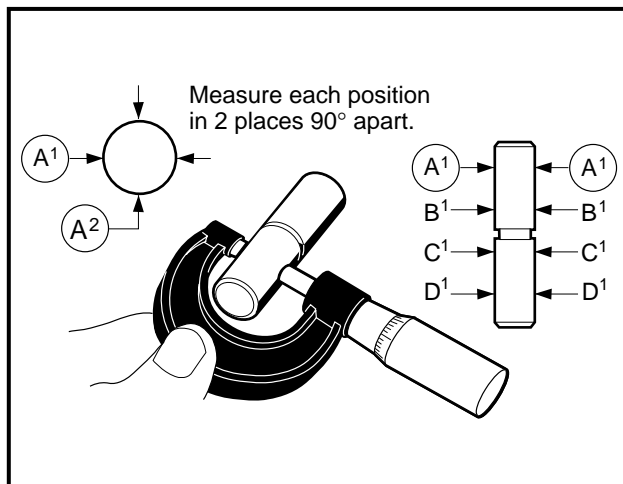


Figure 13-33 Measure O.D. of Rocker Shaft

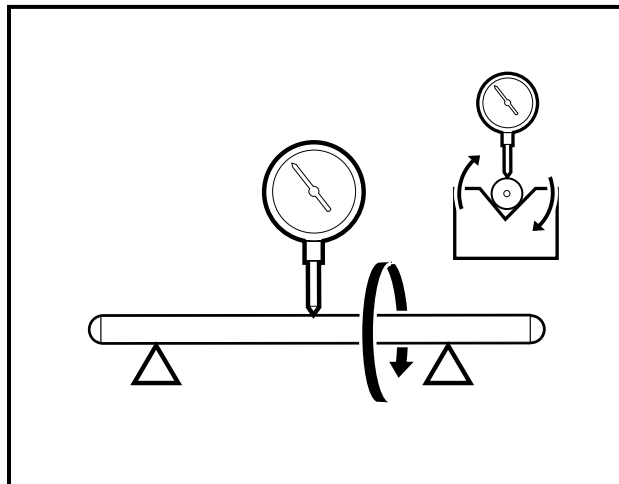


Figure 13-34 Measure Push Rod Bend

ROCKER ARM AND ROCKER SHAFT INSPECTION

1. Using a telescoping gauge, measure the inside diameter of each rocker arm bearing at several points along its length. If the inside diameter is more than the service limit of 0.4754 inch (12.075 mm), replace the rocker arm (**Figure 13-32, Page 13-18**).
2. Using a micrometer, measure the outside diameter of the rocker shaft at several points along its length (**Figure 13-33, Page 13-19**). If the outside diameter is less than the service limit of 0.4704 inch (11.949 mm), replace the shaft.

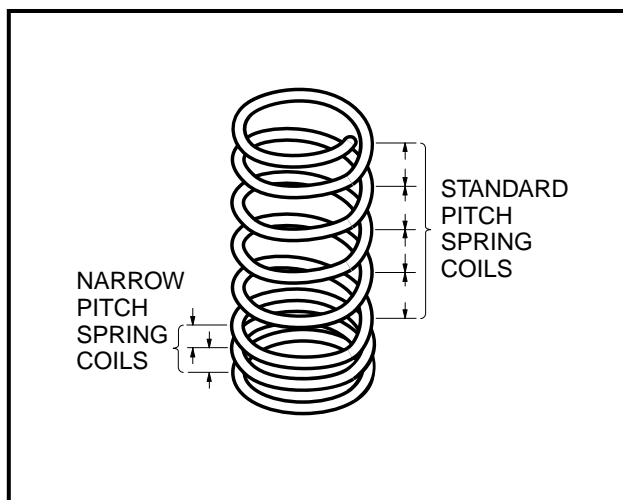


Figure 13-35 Variable-Pitch Valve Spring

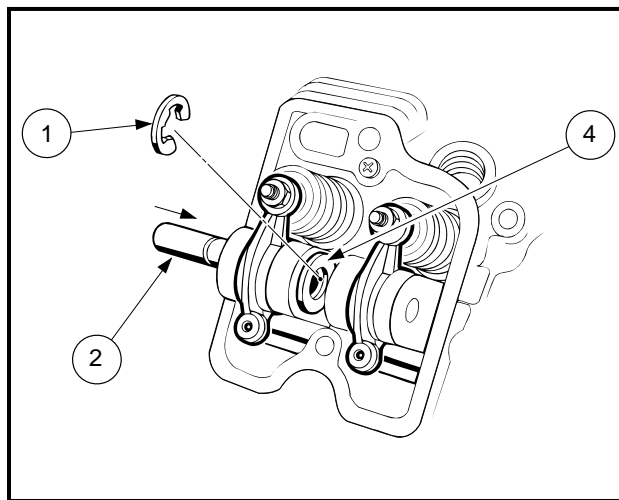


Figure 13-36 Cylinder Head Installation

PUSH ROD INSPECTION

1. Support the rod in V-blocks at each end of rod. Position a dial gauge perpendicular to the rod (**Figure 13-34, Page 13-19**).
2. Turn the rod slowly and read the variation on the gauge.
3. If the push rod is bent more than 0.012 inch (0.3 mm), replace the push rod.

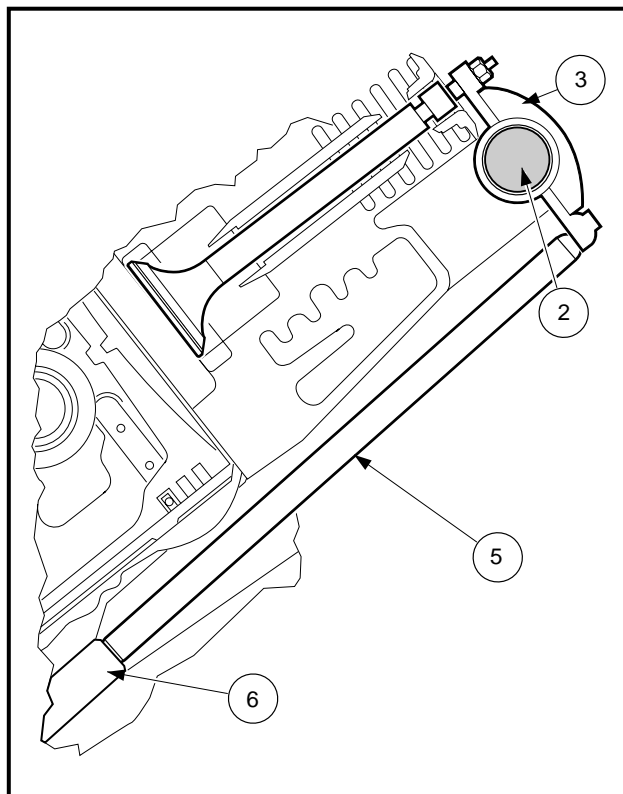


Figure 13-37 Cylinder Head Installation

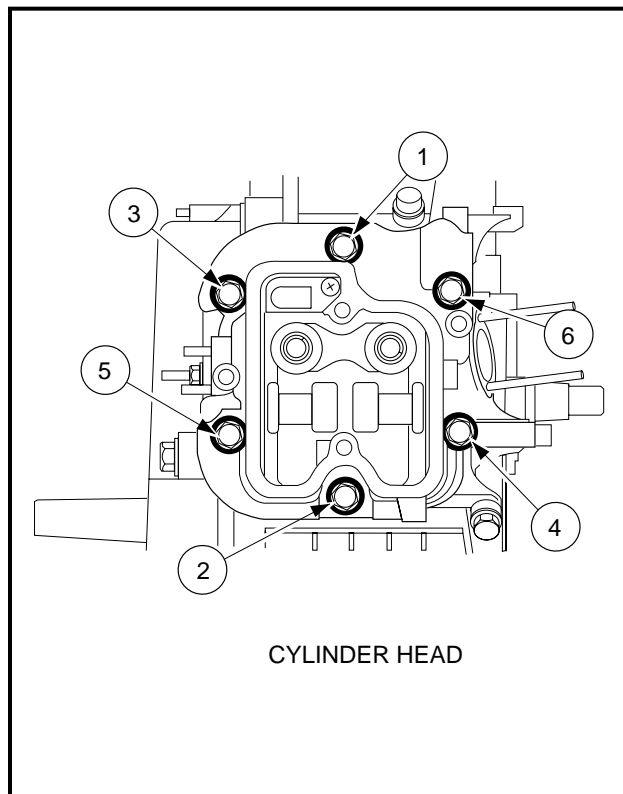


Figure 13-38 Bolt Torque Sequence

CYLINDER HEAD INSTALLATION

Read **DANGER** and **WARNING** on page 13-1.

1. Installation is the reverse of removal. **See Cylinder Head Removal, Page 13-11.**
2. Making sure that each push rod (5) is in place between the rocker arm (3) and the tappet (6) as shown, put the rocker shaft (2) into the posts through the rocker arm (3) and washer (4) (**Figures 13-36 and 13-37**).
3. Slide the washer (4) against the exhaust rocker, and fit the E-ring (1) into the groove in the rocker shaft (2) (**Figure 13-36, Page 13-19**).
4. Install cylinder head assembly to engine.
5. Tighten the bolts down evenly by hand.
6. Using a torque wrench, tighten the six bolts in the sequence shown (**Figure 13-38, Page 13-20**). Increase the torque in four increments of 50 in-lb (6 N·m) and then tighten to final torque of 220 in-lb (25 N·m). **See following CAUTION.**

⚠ CAUTION

- DO NOT TURN ANY ONE BOLT DOWN COMPLETELY BEFORE TIGHTENING THE OTHERS. DOING SO MAY CAUSE THE CYLINDER HEAD TO WARP.

7. Adjust valve clearances.

VALVE CLEARANCE CHECK AND ADJUSTMENT

1. Check and adjust clearance when the engine is cold.
2. Turn the crankshaft until the piston is at the top of the compression stroke.
3. Using a feeler gauge (1), measure the clearance (2) between the adjuster screw (3) and the top of the valve stem (4) (**Figures 13-39 and 13-40**).
4. If necessary, loosen the locknut (3) and turn the adjuster (6) up or down to adjust the clearance to 0.005 inch (0.127 mm) for both intake and exhaust (**Figure 13-39, Page 13-21**).
5. While keeping the adjuster from turning with the screw holder (5) (Club Car Part No. 1016413), tighten the locknut (3) to 90 in-lb (10 N·m) (**Figure 13-39, Page 13-21**).
6. Recheck the clearance on both valves.

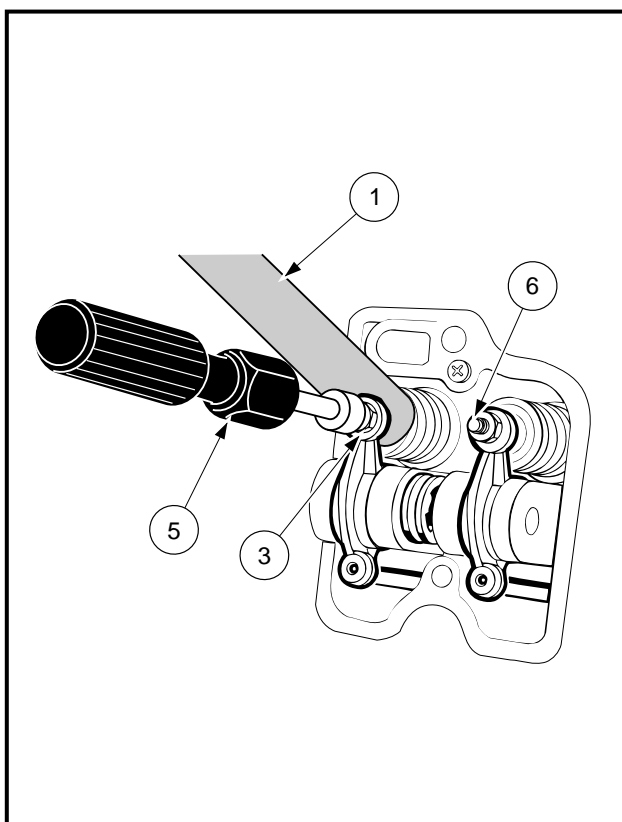


Figure 13-39 Valve Clearance

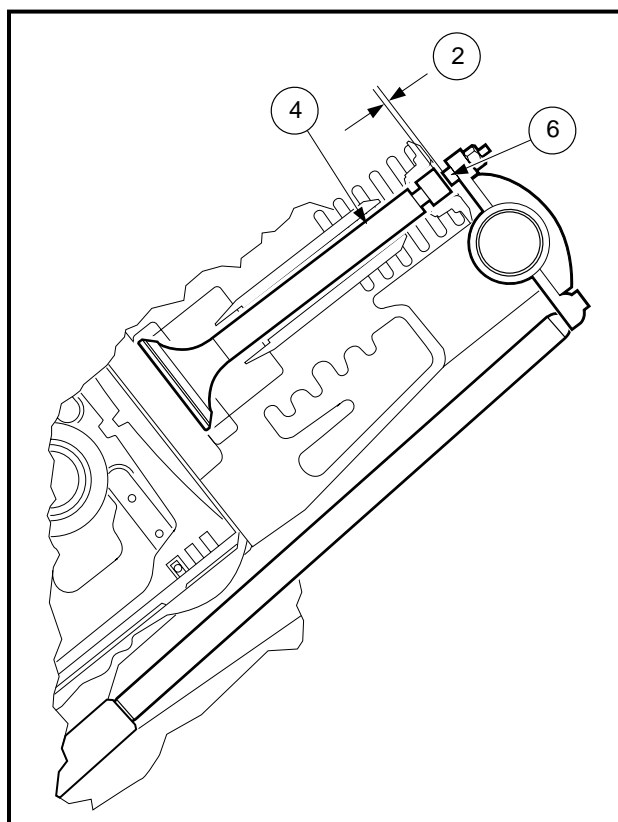


Figure 13-40 Cutaway View of Valve Clearance

BREATHER VALVE (REED VALVE)

General Information

The function of the breather valve is to create a vacuum in the crankcase which prevents oil from being forced out of the engine through the piston rings, oil seals or gaskets.

The breather valve is a reed-type valve which limits the direction of air flow caused by the piston moving up and down. Air can flow out of the crankcase, but the one-way reed valve blocks return flow. It thus maintains a vacuum in the crankcase.

Breather Valve Inspection

1. Inspect the reed valve (1) for sticking or binding. Replace if necessary (**Figure 13-41, Page 13-22**).
2. Inspect the reed valve for hairline cracks, distortion or breakage. Replace if necessary.
3. Inspect the reed valve (1) seating surface. It must not have any nicks or burrs.

Breather Valve Installation

1. Installation is the reverse of removal. **See Breather Valve (Reed Valve) Removal, Page 13-12.**

NOTE

- PLACE THE REED VALVE ON THE SEAT SO THERE IS A SLIGHT GAP (2) 0.008 INCH MAXIMUM (0.203 MM) BETWEEN THE VALVE AND THE SEAT (**FIGURE 13-41, PAGE 13-22**).

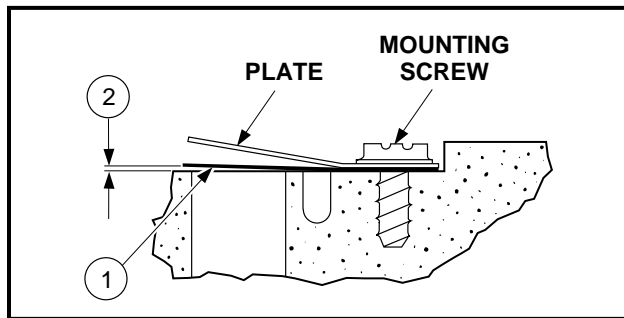


Figure 13-41 Reed Valve

INSTALLATION OF REMAINING ENGINE COMPONENTS

Read **DANGER** and **WARNING** on page 13-1.

1. Install rocker cover.
2. Install lower, upper, and head shrouds (1) along with two-ended bolt (2) (**Figure 13-42, Page 13-23**).

NOTE

- THE SHORTER END OF THE TWO-ENDED BOLT (2) GOES THROUGH WASHER AND UPPER SHROUD.
- TO PREVENT LEAKS, APPLY A LIGHT COAT OF CLEAN ENGINE OIL TO THE O-RING SEAL (7) BEFORE INSTALLATION. CARE SHOULD BE TAKEN DURING INSTALLATION TO AVOID CUTTING OR NICKING THE O-RING SEAL (**FIGURE 13-42, PAGE 13-23**).

3. Install oil filler tube (6) and O-Ring (7) into the large hole in the crankcase cover. Install the upper end of the oil filler tube (6) onto the two-ended bolt (2). Install flange nut (8) and tighten to 50 in-lb (5.7 N·m). Connect the ground wire (3) to the two-ended bolt and install and tighten the locknut (4) to 50 in-lb (5.7 N·m). Insert the dip stick (5) (**Figure 13-42, Page 13-23**).
4. Connect muffler. **See Section 15 – Exhaust System.**
5. Install carburetor (11), throttle spring (12) and throttle spring bracket (13). Tighten to 50 in-lb (5.6 N·m) (**Figure 13-43, Page 13-23**).
6. Connect fuel lines. **See Section 14 – Fuel System.** Tighten fuel line hose clamp at the carburetor to 9 in-lb (1.0 N·m) (**Figure 13-5, Page 13-9**).
7. Install the spark plug and thread it in until finger tight, then tighten the plug to 20 ft-lb (27 N·m).

NOTE

- BEFORE INSTALLING THE PLUG, CHECK THE CONDITION OF THE THREADS IN THE CYLINDER HEAD. SOFTEN DEPOSITS IN CYLINDER HEAD THREADS WITH PENETRATING OIL AND CLEAN THE THREADS WITH A TAP IF NECESSARY.

Installation of Remaining Engine Components, Continued:

8. Install governor cable clevis pin (9) through cable clevis and throttle valve and install cotter pin (10).
9. Install the governor guard (8), flat washer and nylon lock nut. Tighten to 30 in-lb (3.4 N·m) (**Figure 13-43, Page 13-23**).
10. Apply a light film of clean engine oil onto the seal of the new oil filter and install the filter. Tighten the filter 2/3 turn after gasket contact. Fill crankcase with the correct level of oil (**Figure 13-106, Page 13-48**). **See Section 10 – Periodic Maintenance.**
11. Run the engine for three minutes to check for leaking oil.

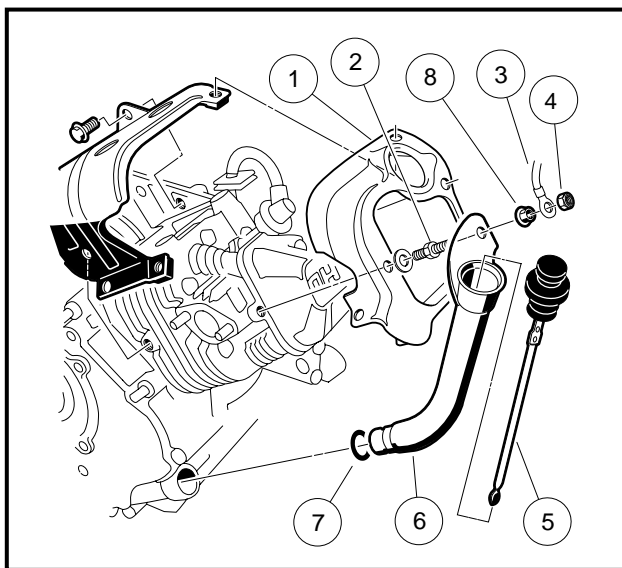


Figure 13-42 Oil Filler Tube and Ground Wire

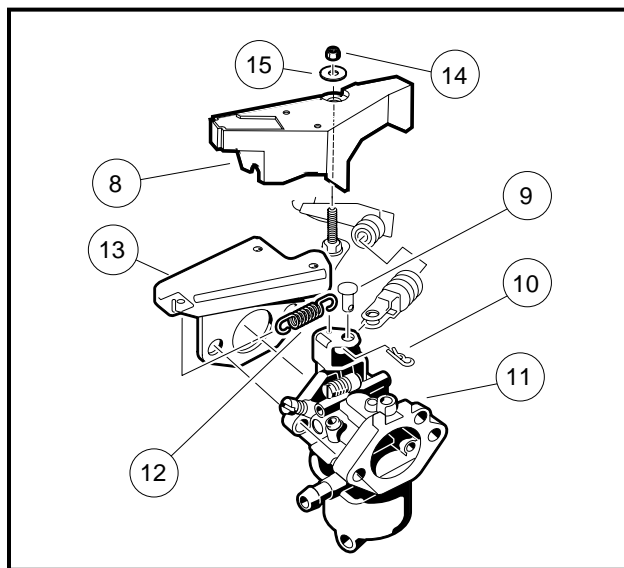


Figure 13-43 Governor Cable Connection

CRANKCASE

Read **DANGER** and **WARNING** on page 13-1.

ENGINE REMOVAL

To perform repairs on crankcase components, the engine must be removed from the vehicle.

CAUTION

- BEFORE REMOVAL AND DISASSEMBLY, CLEAN THE ENGINE.

1. Remove the powertrain by performing steps 1 through 14, pages 16-7 through 16-10 in Section 16 – Unitized Transaxle.
2. Remove starter-generator. **See Section 12 – Electrical System.**
3. Remove drive belt. **See Section 17 – Torque Converter.**
4. Remove drive clutch. **See Section 17 – Torque Converter and following NOTE.**

NOTE

- THE CRANKSHAFT HAS **LEFT-HAND** THREADS AT THE CLUTCH MOUNTING HOLE.

5. Remove muffler. **See Section 15 – Exhaust System.**

6. Remove engine mounting hardware (Items 1, 2, 5 and 6) **(Figure 13-48, Page 13-25)**.
7. Lift engine from the mounting plate.
8. Remove crankcase oil drain plug and filler tube. Tip the engine slightly to allow all of the oil to drain from the crankcase. Dispose of engine oil properly.

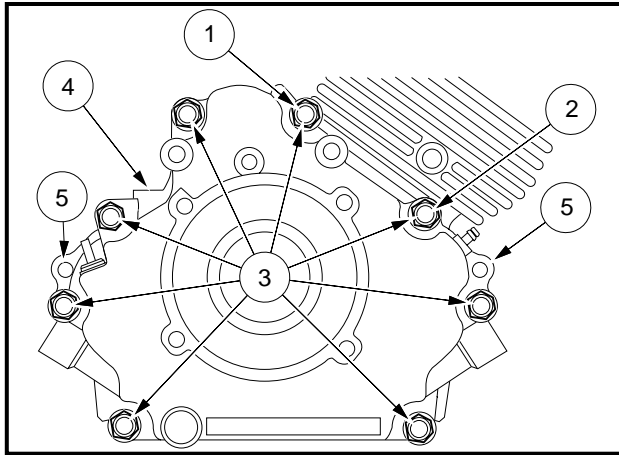


Figure 13-44 Crankcase Cover

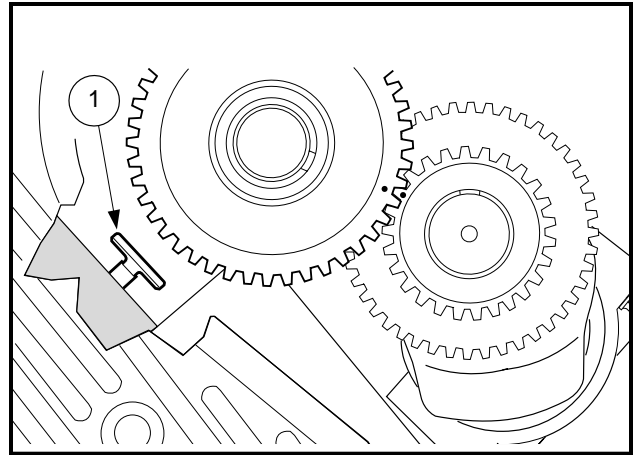


Figure 13-45 Timing Marks

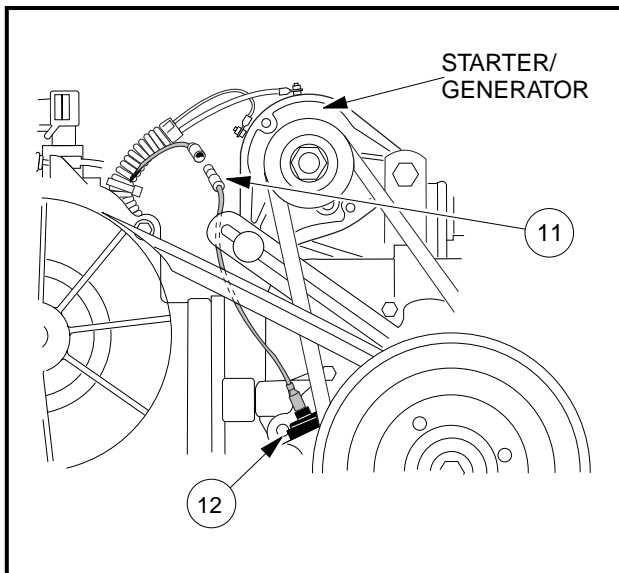


Figure 13-46 Oil Level Sensor Wire

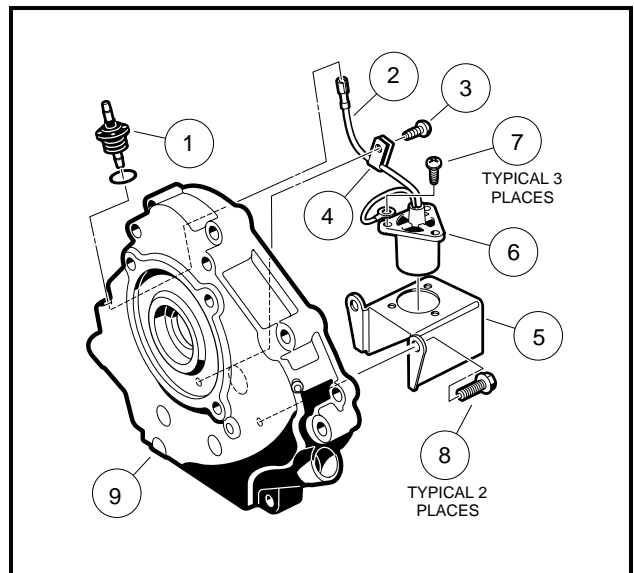


Figure 13-47 Oil Level Sensor

CRANKCASE COVER REMOVAL

1. Remove yellow jumper wire (11) from cord connector (12) **(Figure 13-46, Page 13-24)**.
2. Remove nuts and clamps at two-ended bolts (1 and 2) **(Figure 13-44, Page 13-24)**.
3. Remove eight bolts (3) and remove the crankcase cover (4) **(Figure 13-44, Page 13-24)**. See following **NOTE**.

NOTE

- IF THE CRANKCASE COVER STICKS, TAP LIGHTLY WITH A PLASTIC Mallet ON ALTERNATE SIDES NEAR THE DOWEL PINS (5) **(FIGURE 13-44, PAGE 13-24)**.

4. Remove the crankcase cover gasket completely. It may stick to the flanged surface of the crankcase.

OIL LEVEL SENSOR

Testing the Oil Level Sensor

See Section 11, Test Procedure 21, Page 11-33.

Oil Level Sensor Removal

1. If not already removed, remove crankcase cover. **See Crankcase Cover Removal, Page 13-24.**
2. Disconnect the oil level sensor wire (2) from the cord connection (1) (**Figure 13-47, Page 13-24**).
3. Remove the screw (3) from the wire clamp (4).
4. Remove the two mounting screws from the inside of the crankcase cover and remove the oil level sensor and bracket.
5. If necessary, remove the three screws (7) that hold the sensor to the bracket (5).

Oil Level Sensor Installation

1. If the oil level sensor was removed from the bracket, install sensor (6) into bracket (5) and secure with three screws (7) (**Figure 13-47, Page 13-24**). Tighten to 16.8 in-lb (1.9 N·m).
2. Position sending unit and bracket on inside of crankcase and install two mounting screws.
3. Connect sensor wire (2) to cord connector (1) (**Figure 13-47, Page 13-24**).
4. Install screw (3) through wire clamp and into crankcase cover. Tighten to 30 in-lb (3.4 N·m).

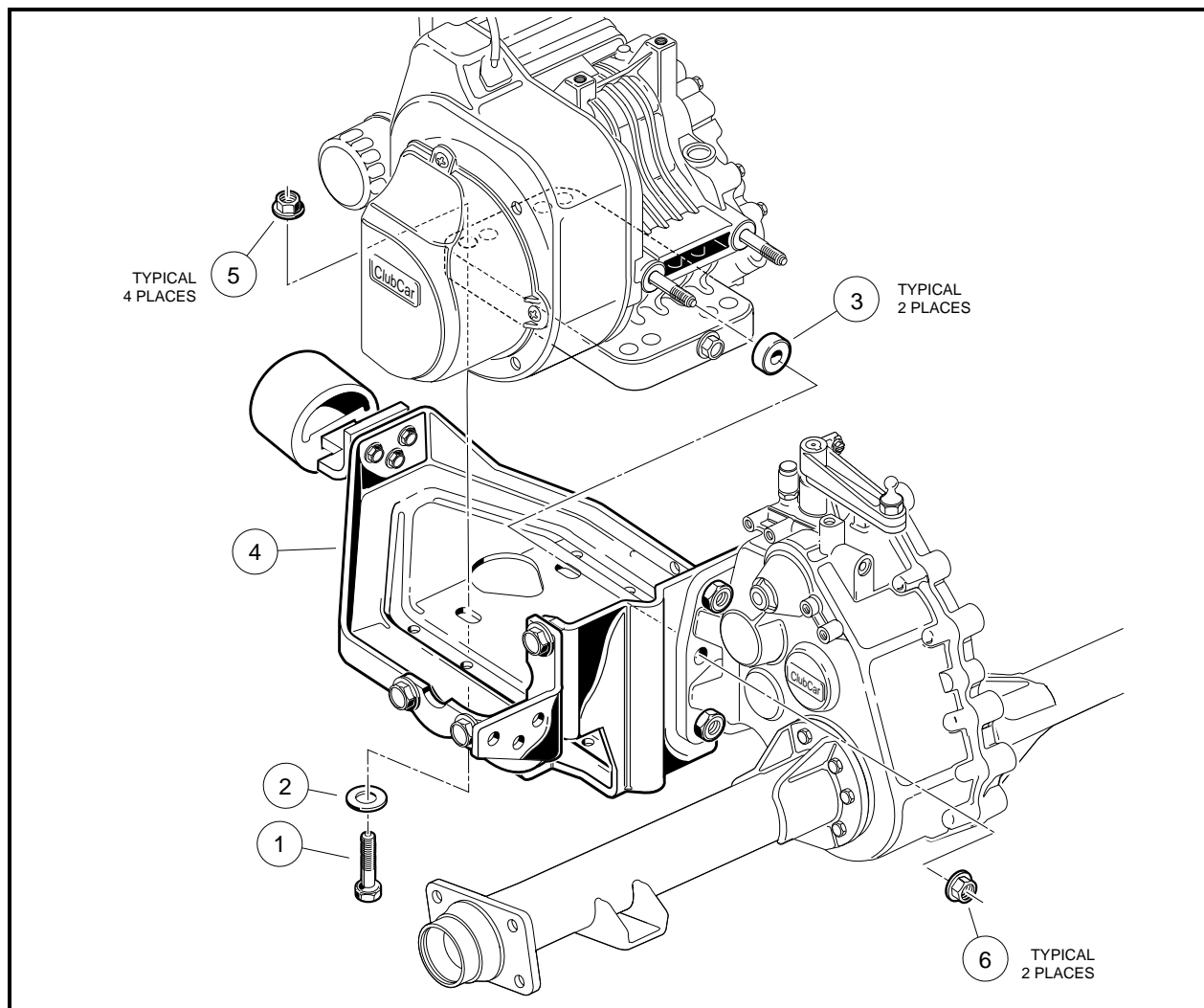


Figure 13-48 Engine Mounting Plate

CAMSHAFT AND TAPPETS

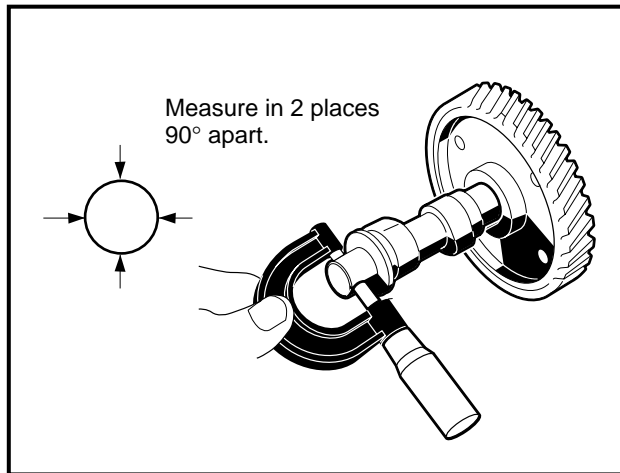


Figure 13-49 Measure Camshaft Journals

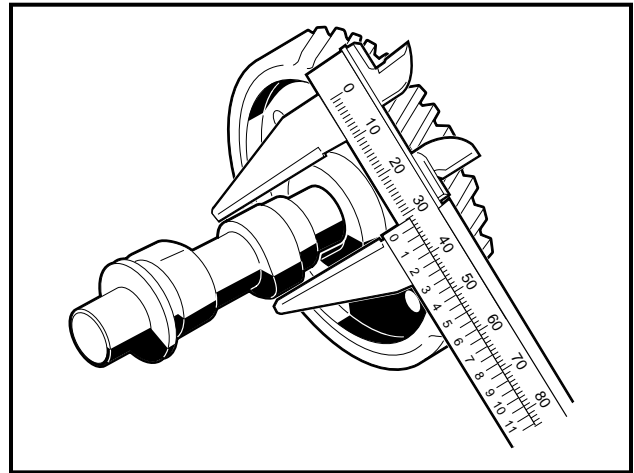


Figure 13-50 Measure Camshaft Lobes

Camshaft Removal

1. Turn the engine upside down to keep tappets (1) from catching the cam lobes (**Figure 13-45, Page 13-23**).
2. Take the camshaft out of the engine block. Pull both tappets out.

NOTE

- DUE TO INDIVIDUALIZED WEAR PATTERNS, EACH TAPPET SHOULD BE REINSTALLED IN THE SAME POSITION FROM WHICH IT WAS REMOVED.

Camshaft Inspection

1. Inspect the camshaft for wear or broken gear teeth.
2. Inspect the camshaft gear to ensure it is securely fastened to the shaft. If the cam gear is loose, replace the camshaft.
3. Measure camshaft journals and cam lobes with a micrometer at the points shown (**Figures 13-49 and 13-50**).
4. If camshaft journal diameter is less than 0.9026 inch (22.927 mm) at either end of the shaft, replace camshaft.
5. If the lobe height is less than 1.287 inches (32.690 mm) for either lobe, replace the camshaft.

Camshaft Installation

See Page 13-46.

PISTON AND CONNECTING ROD

Read **DANGER** and **WARNING** on page 13-1.

NOTE

- THE CONNECTING ROD AND CAP MUST STAY TOGETHER AS A SET. DO NOT MIX WITH PARTS FROM ANY OTHER ENGINE.

Piston and Connecting Rod Removal

1. Turn crankshaft to expose the two connecting rod cap bolts (1) (**Figure 13-51, Page 13-27**).
2. Loosen the cap bolts and take them out together with the connecting rod cap (2).
3. With cylinder head removed, push the piston/connecting rod assembly out of the cylinder.

Piston and Connecting Rod Separation

1. Remove two retaining rings holding the piston pin in place.
2. Remove the piston pin.

Piston Inspection and Repair

1. Remove all deposits from the piston.
2. Clean the carbon from the piston ring grooves. **See following CAUTION.**

⚠ CAUTION

- NEVER CLEAN THE PISTON HEAD WITH THE ENGINE ASSEMBLED. CARBON PARTICLES WILL FALL BETWEEN THE PISTON AND CYLINDER WALL AND MAY CAUSE SEVERE CYLINDER WEAR.

3. Be sure the oil return passages in the ring grooves are open.
4. Visually inspect the piston rings and ring grooves for uneven wear or damage. Replace the piston and/or piston rings if uneven wear or damage is present or if they exceed the wear limits.
5. Using a new piston ring and a feeler gauge, measure the clearance between the grooves and ring at several points around the grooves (**Figure 13-52, Page 13-27**).
6. If the top groove has a clearance greater than 0.0063 inch (0.16 mm), replace the piston.
7. If the second groove has a clearance greater than 0.0055 inch (0.14 mm), replace the piston.
8. The oil ring is made of three pieces: upper and lower rails and expander. It is difficult to measure the ring groove clearance and thickness. Inspect visually for wear or damage.

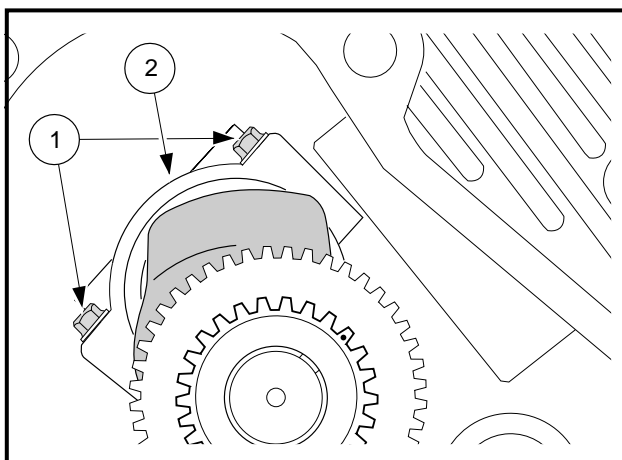


Figure 13-51 Connecting Rod Cap Bolts

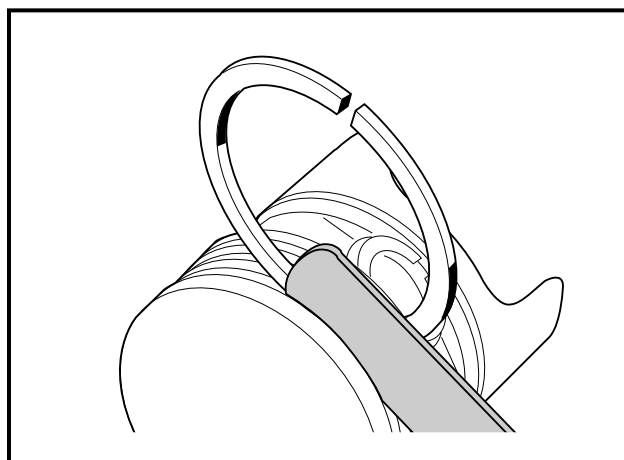


Figure 13-52 Measure Piston Ring and Groove Clearance

Piston Ring Inspection

1. Insert the ring squarely into the cylinder bore to a point approximately 1 inch (25 mm) down from the top of the cylinder. **See following NOTE.**

NOTE

- USE THE TOP OF THE PISTON TO PUSH THE RING INTO THE BORE TO BE SURE IT IS SQUARE.

2. Using a feeler gauge, measure the ring end-gap (**Figure 13-53, Page 13-28**).

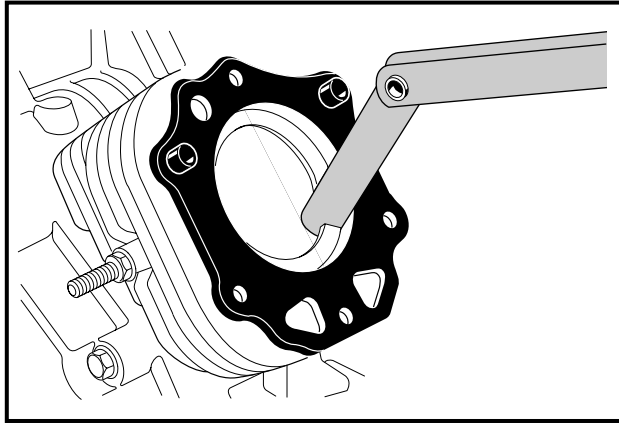


Figure 13-53 Measure Ring End-Gap

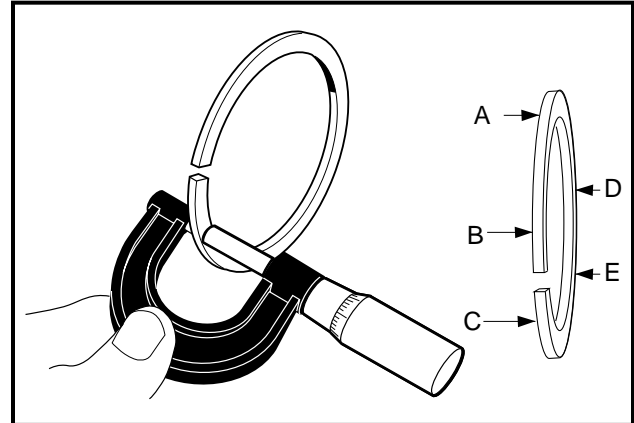


Figure 13-54 Measure Piston Ring Thickness

3. If the end-gap of any ring is greater than 0.0472 inch (1.199 mm), replace the entire set of rings.
4. Using a micrometer, measure the thickness of both piston rings at several points around the rings (Figure 13-54, Page 13-28).
5. If either ring thickness is less than 0.0566 inch (1.438 mm), replace the entire set of rings.

NOTE

- IT IS DIFFICULT TO MEASURE EXACTLY THE OIL RING THICKNESS. REPLACE THE OIL RING WHENEVER THE COMPRESSION RINGS (TOP AND SECOND) ARE REPLACED.

Piston Pin Inspection

1. Using a micrometer, measure the outside diameter of the piston pin at several points along its length (Figure 13-55, Page 13-28).
2. If the pin diameter is smaller than 0.747 inch (18.974 mm), replace the piston pin.
3. Using an inside micrometer or telescoping gauge, measure the inside diameter of the piston pin hole in the piston at several points (Figure 13-56, Page 13-28).
4. If the inside diameter exceeds 0.7439 inch (18.895 mm), replace the piston.

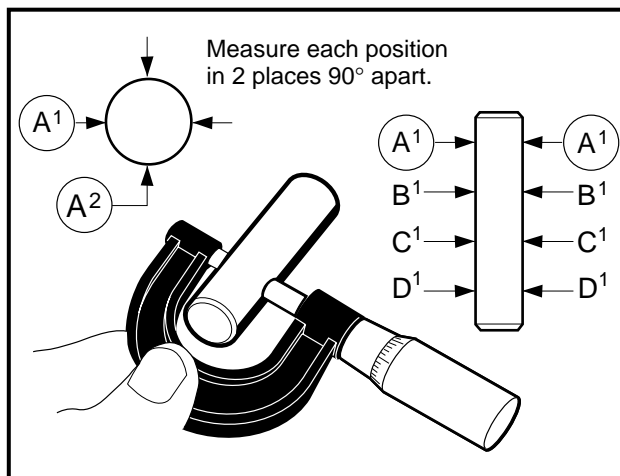


Figure 13-55 Measure O.D. of Piston Pin

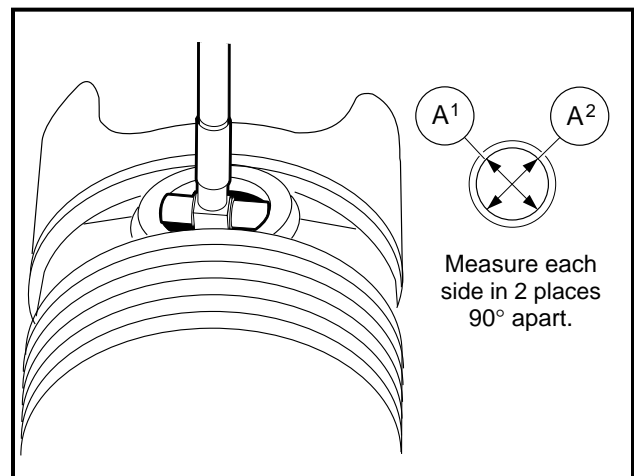


Figure 13-56 Measure I.D. of Piston Pin Hole

Connecting Rod Inspection

1. Clean and inspect the bearing surfaces of the connecting rod and cap. Replace parts if scored.
2. Using an inside micrometer or a telescoping gauge, measure the inside diameter of the connecting rod small bore at several points along its length (**Figure 13-57, Page 13-29**).
3. If the inside diameter exceeds 0.7500 inch (19.050 mm), replace the connecting rod.
4. Remount the connecting rod cap to the connecting rod at the large bore end, aligning the pilot groove on the rod. Screw in the connecting rod bolts and tighten them to 16.5 ft-lb (23 N·m).
5. Using a telescoping gauge or an inside micrometer, measure the inside diameter of the large bore at several points along its length (**Figure 13-58, Page 13-29**).
6. If the inside diameter exceeds 1.4003 inches (35.568 mm), replace the connecting rod.

NOTE

- THE CONNECTING ROD AND CAP MUST STAY TOGETHER AS A SET. DO NOT MIX WITH PARTS FROM ANY OTHER ENGINE.
- IF THE CONNECTING ROD IS BENT OR TWISTED, IT MUST BE REPLACED.

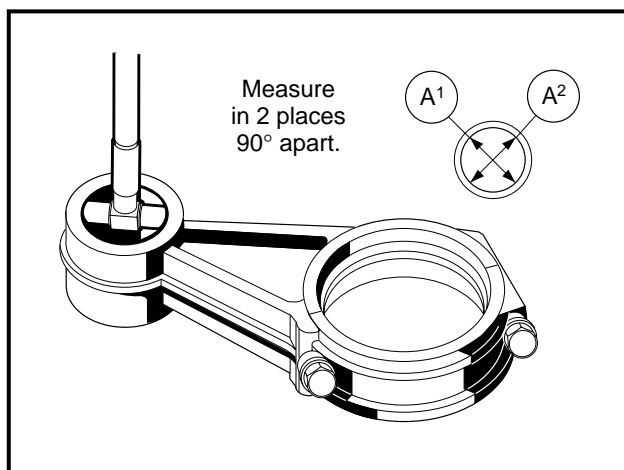


Figure 13-57 Measure I.D. of Small Bore

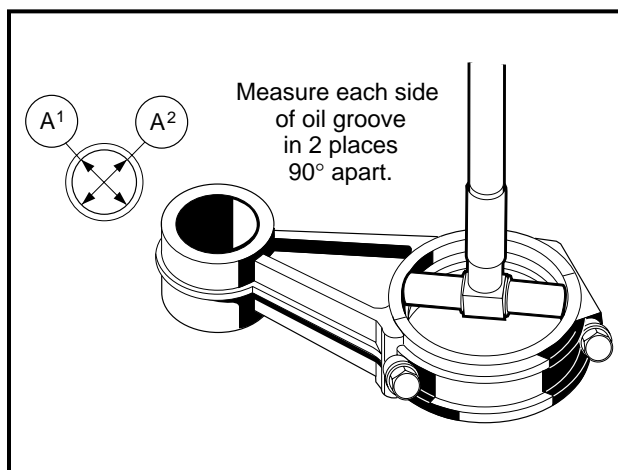


Figure 13-58 Measure I.D. of Large Bore

Piston and Connecting Rod Installation

See Page 13-43.

CYLINDER BLOCK

Read DANGER and WARNING on page 13-1.

While the engine is disassembled, inspect the cylinder block for cracks, stripped bolt holes, broken fins, or cylinder wall scoring. Repair or replace as necessary.

1. Use an inside micrometer or telescoping gauge, together with a micrometer, to measure the cylinder bore.
2. Make the first measurement parallel with the crankshaft and the second at right angles to the crankshaft at three different locations in the bore. The first measurement location is 0.4 inch (10 mm) from the top of the cylinder. The second location is in the center or 2.4 inches (60 mm) from the top, and the third location is 0.3 (8 mm) from the bottom of the cylinder or bottom of ring travel (**See locations 1, 2, and 3 in Figure 13-59, Page 13-30**).

- The standard bore diameter is 3.0700 - 3.0708 inches (77.980 - 78.000 mm).
 - The maximum cylinder bore diameter wear limit is 3.0735 inches (78.067 mm).
 - The maximum acceptable out of round cylinder bore is 0.0022 inch (0.056 mm).
3. If the cylinder bore is not within these measurements, the cylinder bore will need to be resized.

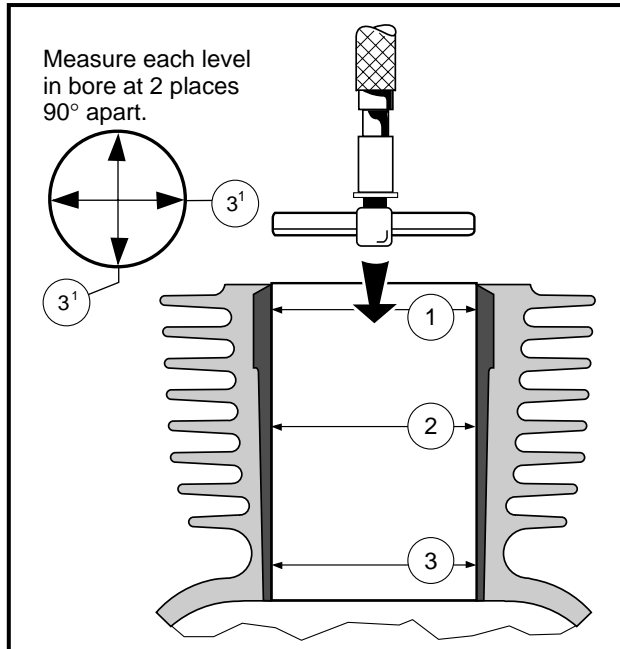


Figure 13-59 Measure Cylinder Bore

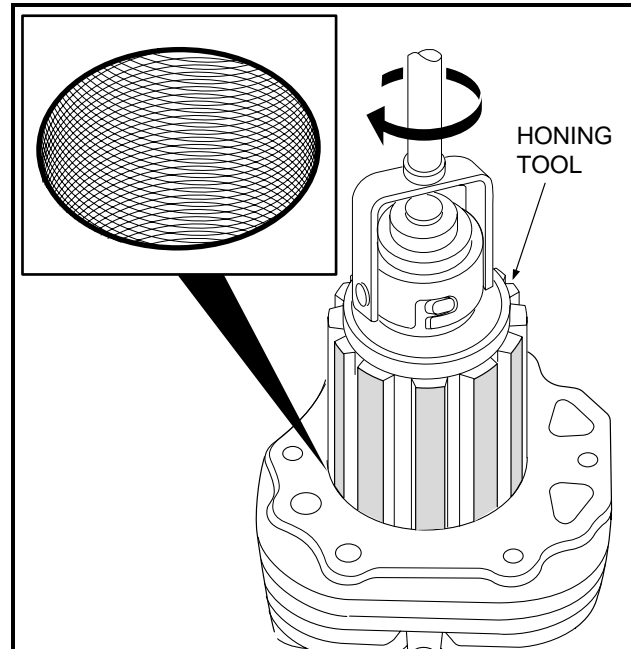


Figure 13-60 Hone Cylinder

To Resize Bore to Next Oversize

Always resize the bore to exactly 0.010 inch (0.25 mm) or to exactly 0.020 inch (0.50 mm) over standard size.

1. When the bore is resized to 0.010 inch over standard size, the new bore dimension is 3.0791 - 3.0799 inches (78.210 - 78.230 mm). When the bore is resized to 0.020 inch over standard size, the new bore dimension is 3.0890 - 3.0898 inches (78.460 - 78.480 mm). **See Specifications for Resizing Cylinder Bore Table, Page 13-50.**

NOTE

- ALLOW FOR SHRINKAGE (FROM THE FINAL SIZE) OF 0.0003 - 0.0004 INCH (0.0076 - 0.0102 MM) WHICH WILL OCCUR WHEN THE CYLINDER COOLS DOWN.

2. Hone the cylinder that is to be 0.010 inch over standard size so that the final bore size diameter is 3.0799 - 3.0807 inches (78.230 - 78.250 mm). The final honed bore diameter for a 0.020 inch over standard size bore is 3.0898 - 3.0906 inches (78.480 - 78.500 mm). **See Specification for Resizing Cylinder Bore, Page 13-50. See following NOTE.**

NOTE

- IMPORTANT: THE CYLINDER WALL FINISH SHOULD HAVE A 40° TO 60° CROSS-HATCH PATTERN (**FIGURE 13-60, PAGE 13-30**).
- DO NOT USE SOLVENTS OR GASOLINE TO CLEAN CYLINDER AFTER HONING.

3. After honing, clean the cylinder wall thoroughly using soap, warm water and clean rags.
4. Dry the cylinder and coat with engine oil.

⚠ CAUTION

- THE CYLINDER MUST BE THOROUGHLY CLEANED AFTER HONING TO ELIMINATE ALL GRIT.

IGNITION COIL AND FLYWHEEL**Ignition Coil and Flywheel Removal**

1. Loosen three screws and remove the remaining four screws attaching the flywheel housing as shown, then remove the housing (**Figure 13-61, Page 13-31**).
2. Disconnect the ignition coil (1) from its primary lead wire at the connector (2). Remove the two bolts (3) and take out the ignition coil (**Figure 13-62, Page 13-31**).
3. Hold the flywheel (4), **not the fan** (7), with a strap wrench (5) and, using a 22 mm socket, remove the flywheel nut (and flat washer) by turning it counterclockwise (**Figure 13-63, Page 13-32**).

⚠ CAUTION

- THE FLYWHEEL NUT HAS RIGHT-HAND THREADS. TURN IT CLOCKWISE TO TIGHTEN, OR COUNTERCLOCKWISE TO LOOSEN.
- DO NOT DAMAGE THE FAN BLADES WITH THE STRAP WRENCH. DO NOT PLACE SCREWDRIVER OR PRY BAR IN THE FAN BLADES.

4. Remove the flywheel with a puller (Club Car Part No. 1016627).
5. Remove the flywheel key from its groove.

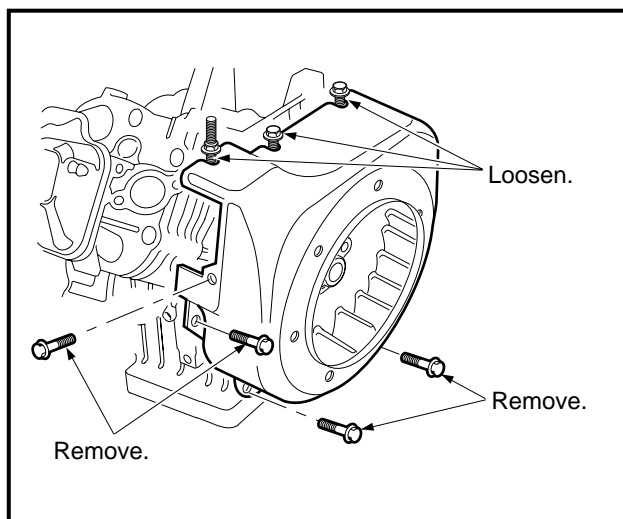


Figure 13-61 Flywheel Housing

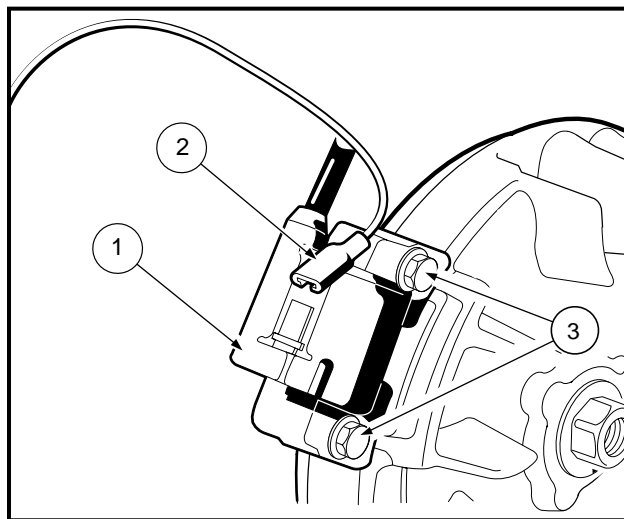


Figure 13-62 Ignition Coil

Flywheel Installation

See Engine Assembly on Page 13-47.

Ignition Coil Inspection and Repair

See Test Procedure 15, Section 11, Page 11-30.

Ignition Coil Installation

1. Installation is the reverse of removal.
2. While tightening the two bolts (3), use a bronze feeler gauge to adjust the ignition coil air gap to 0.012 inch (0.304 mm) (**Figure 13-64, Page 13-32**).
3. Tighten the two ignition coil bolts to 30 in-lb (3.4 N·m).

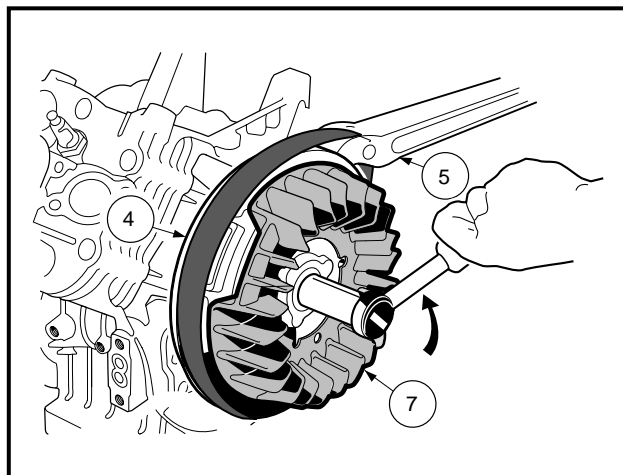


Figure 13-63 Flywheel Nut Removal

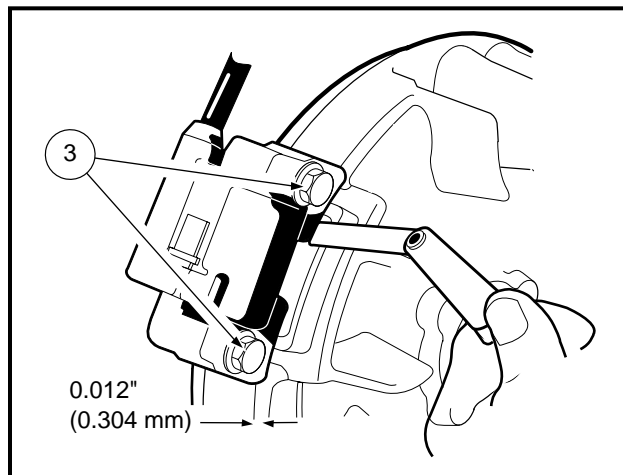


Figure 13-64 Adjust Ignition Coil Air Gap

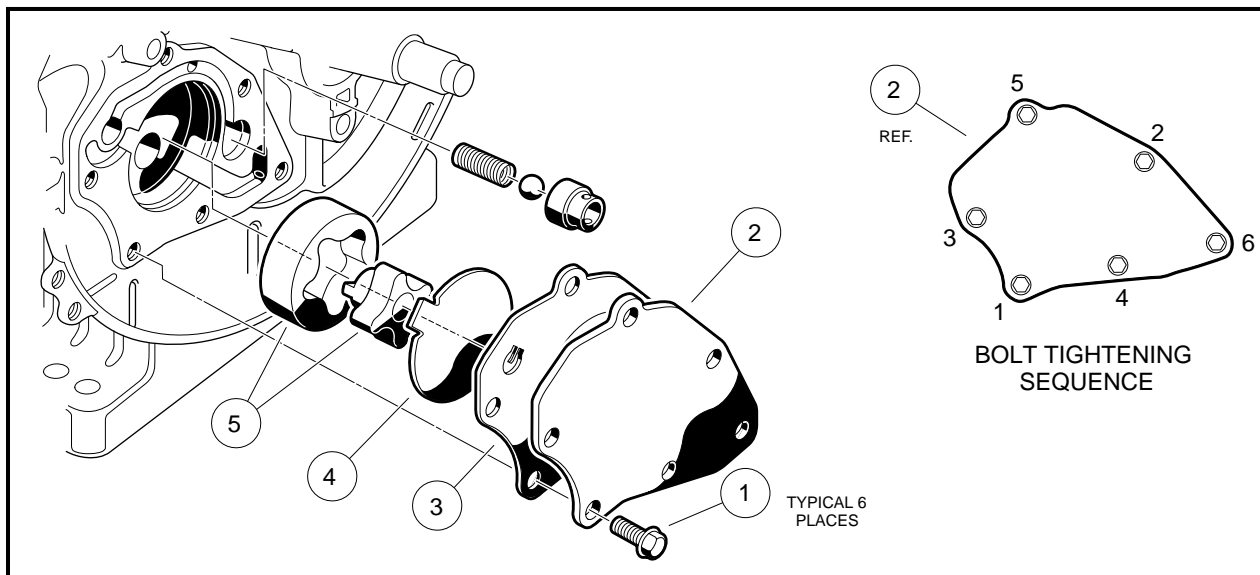


Figure 13-65 Oil Pump

OIL PUMP

Read **DANGER** and **WARNING** on page 13-1.

Oil Pump Cover Removal

1. Remove the six screws (1) and take off the oil pump cover (2) (**Figure 13-65, Page 13-32**).
2. Peel off the oil pump cover gasket (3).
3. Remove the pump gear cover plate (4) (**Figure 13-65, Page 13-32**).

Oil Pump Inspection

1. Check the clearance between the inner and outer rotors (5) with a feeler gauge (6). Measure the clearance between the high point of the inner rotor and the high point of the outer rotor (**Figure 13-66, Page 13-33**).
2. Replace both rotors as a set if the measurement exceeds 0.012 inch (0.3 mm).
3. Remove inner and outer rotors (5).
4. Inspect the inner and outer oil pump rotors. If the rotors are worn or damaged, replace them.
 - 4.1. Measure the pump shaft bearing surface. Replace both rotors as a set if the measurement is less than 0.4971 inch (12.627 mm) (**Figure 13-67, Page 13-33**).
 - 4.2. Using a micrometer, measure the diameter of the outer rotor at several points (**Figure 13-68, Page 13-33**).
 - 4.3. If the rotor diameter is less than 1.5931 inches (40.467 mm), replace both rotors.
 - 4.4. Using a micrometer, measure the thickness of the outer rotor (**Figure 13-69, Page 13-33**).
 - 4.5. If the rotor thickness is less than 0.3905 inch (9.920 mm), replace both rotors.

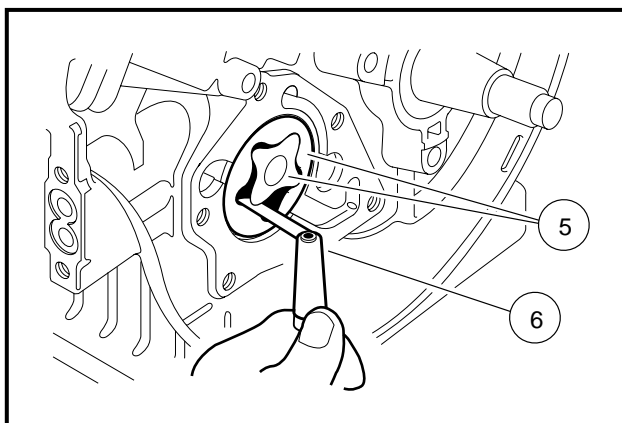


Figure 13-66 Check Clearance Between Rotors

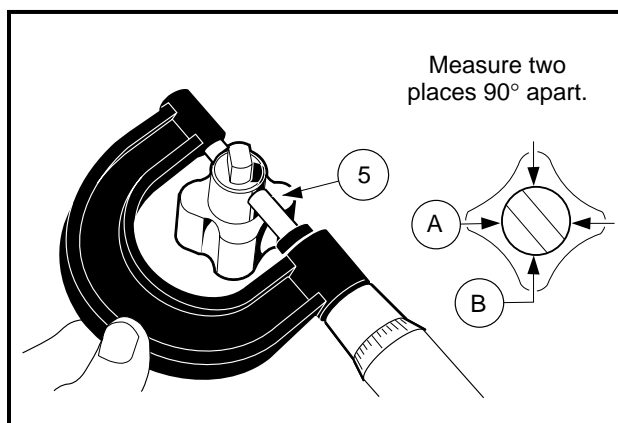


Figure 13-67 Measure Pump Shaft Bearing Surface

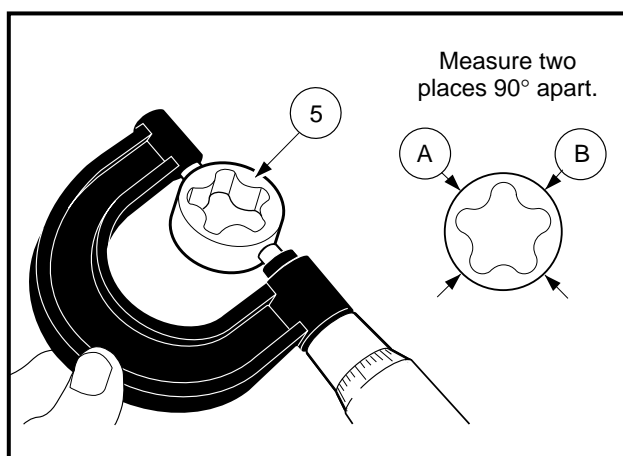


Figure 13-68 Measure O.D. of Outer Rotor

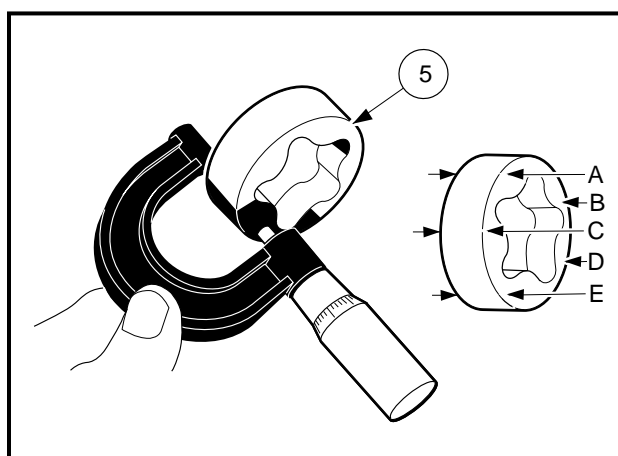


Figure 13-69 Measure Thickness of Outer Rotor

OIL PRESSURE RELIEF VALVE

Oil Pressure Relief Valve Removal

1. Remove the oil pump cover. **See Oil Pump Cover Removal, Page 13-32.**
2. Remove the valve seat (1), ball (2) and spring (3) (**Figure 13-71, Page 13-34**).

Oil Pressure Relief Valve Inspection

1. Note the condition of the ball (2) and the valve seat (1). They must not have any nicks or burrs (**Figure 13-71, Page 13-34**).
2. Inspect the relief valve spring (3) for pitting, cracks, rusting and burrs. Replace it if necessary.
3. Measure free length of the spring (3) with a vernier caliper (**Figure 13-72, Page 13-34**). If the free length of the relief valve spring is less than 0.748 inch (19.00 mm), replace the spring.

Oil Pressure Relief Valve Installation

1. Installation is the reverse of removal. If necessary, put the ball in position and lightly tap the ball with a plastic hammer to form a perfect seat.

Oil Pump Installation

⚠ CAUTION

- DO NOT ALLOW ANY DUST OR OTHER FOREIGN MATTER INTO THE OIL PUMP.

1. Installation is the reverse of removal.
2. Install the inner rotor with its tang in the slot in the end of the camshaft (**Figure 13-70, Page 13-34**).
3. Install six bolts (1) and finger tighten. Then tighten to 7 ft-lb (9.5 N·m) in the sequence shown (**Figure 13-65, Page 13-32**). After tightening bolts, check torque of first bolt.

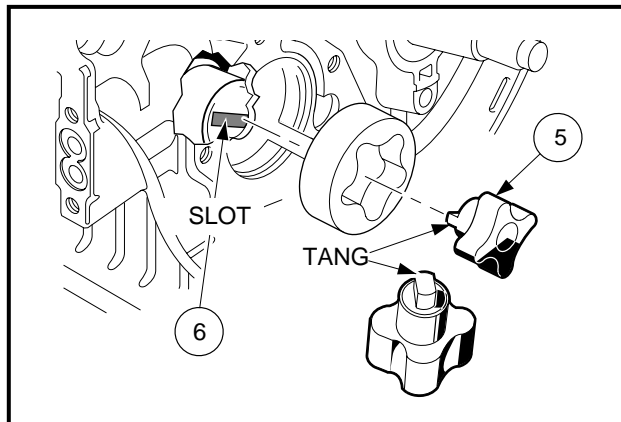


Figure 13-70 Install Inner Rotor

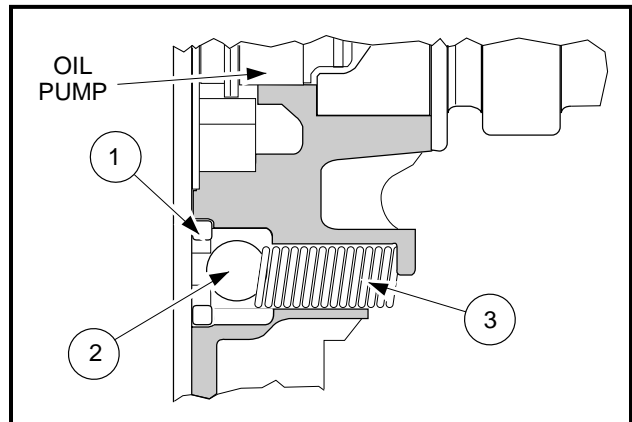


Figure 13-71 Oil Pressure Relief Valve

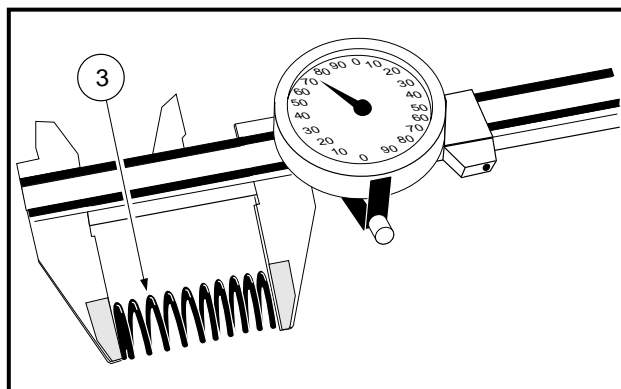


Figure 13-72 Measure Free Length of Spring

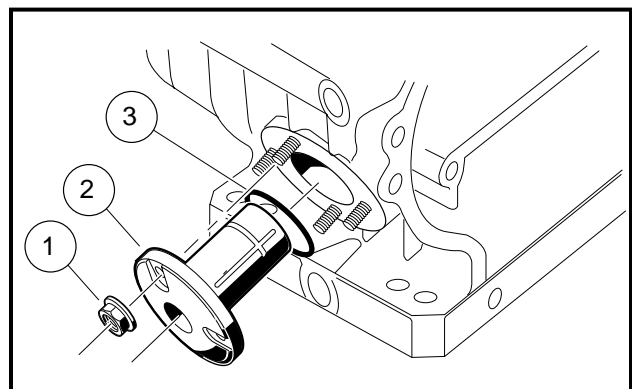


Figure 13-73 Counterbalance Guide Shaft and O-Ring

CRANKSHAFT AND COUNTERBALANCE

Read **DANGER** and **WARNING** on page 13-1.

Crankshaft and Counterbalance Removal

1. Remove the four nuts (1) and pull out the counterbalance guide shaft (2) and the O-Ring (3) (**Figure 13-73, Page 13-34**).
2. Pull out the crankshaft and the counterbalance together as an assembly (**Figure 13-76, Page 13-36**).

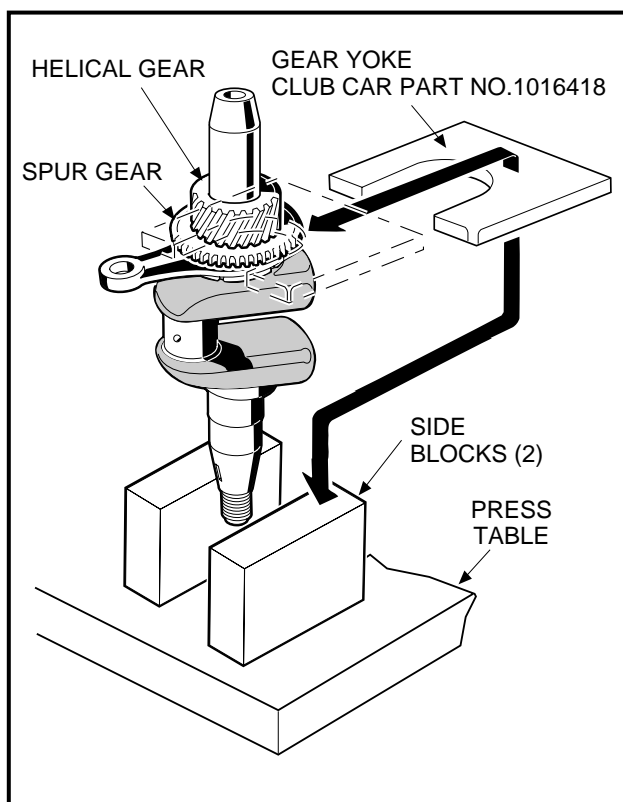


Figure 13-74 Place Assembly In Press

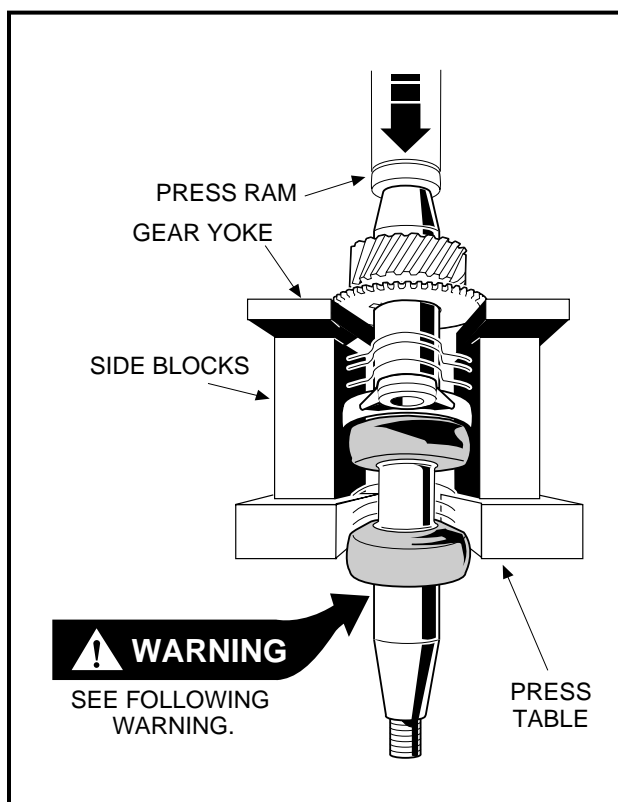


Figure 13-75 Remove Helical and Spur Gears

Crankshaft and Counterbalance Disassembly

1. Slide the spacer (2) and the link rod (3) off the flywheel end of the crankshaft. Remove the counterbalance from the remaining link rod (**Figure 13-76, Page 13-36**). **Go to Link Rod Inspection, Page 13-36.**
2. If the link rods need replacing, place the gear yoke (Club Car Part No. 1016418) under the spur gear with the small end of the connecting rod located opposite the crankpin (**Figure 13-74, Page 13-35**).
3. Position the gear yoke with the side blocks positioned as close to the crankshaft as possible (**Figure 13-74, Page 13-35**).
4. Using a press, push on the end of the crankshaft to pull the spur gear and the helical gear off the crankshaft (**Figure 13-75, Page 13-35**). **See following WARNING and CAUTION.**

⚠ WARNING

- SUPPORT THE CRANKSHAFT WHILE PRESSING. THIS WILL PREVENT THE CRANKSHAFT FROM DROPPING TO THE FLOOR AFTER THE GEAR HAS BEEN REMOVED.

⚠ CAUTION

- ALWAYS USE A PRESS WHEN REMOVING THE SPUR GEAR AND HELICAL GEAR FROM, OR INSTALLING THEM ON, THE CRANKSHAFT.

5. Remove the woodruff key.
6. Slide the remaining link rod off the crankshaft.

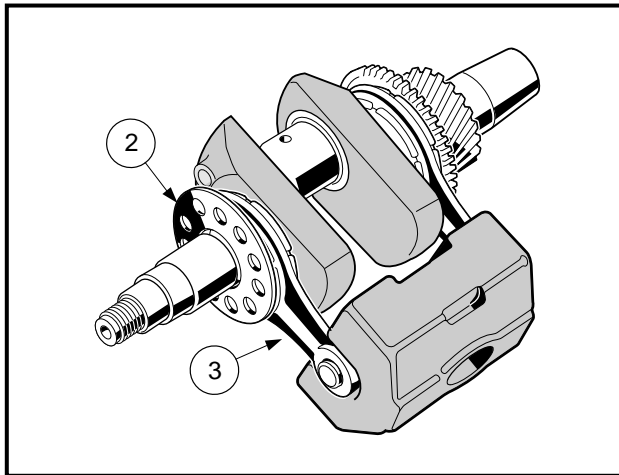


Figure 13-76 Crankshaft and Counterbalance

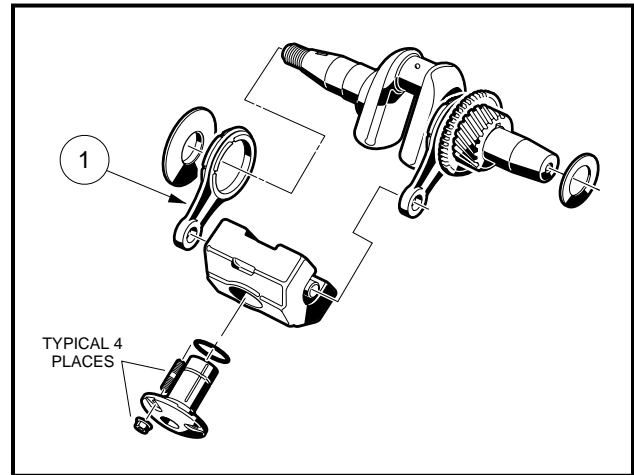


Figure 13-77 Inspect Link Rod

Link Rod Inspection

1. Clean and inspect the link rod (1) bearing surfaces. If the bearing surface of the small end is scored or damaged, replace the link rod. If the large end bearing is scored or damaged, the bearing must be replaced (**Figure 13-77, Page 13-36**).
 - 1.1. Using a telescoping gauge and micrometer, measure both inside bearing surfaces at several points.
 - 1.2. If the inside diameter of the small end is greater than 0.4746 inch (12.057 mm), replace the link rod (**Figure 13-78, Page 13-37**).
 - 1.3. If the inside diameter of the large end is greater than 1.8554 inches (47.127 mm), replace the bearing (**Figure 13-79, Page 13-37**). **See following note.**

NOTE

- DO NOT REMOVE THE LINK ROD ON THE PTO (POWER TAKE-OFF) SIDE UNLESS LINK ROD ON THE OPPOSITE END NEEDS REPLACEMENT. THE CRANK-GEAR IS VERY TIGHTLY FITTED TO THE CRANKSHAFT SO THAT IT CAN TRANSFER ENGINE TORQUE TO THE CAMSHAFT (WHICH ALSO FUNCTIONS AS A POWER TAKE-OFF SHAFT) (**FIGURE 13-77, PAGE 13-36**). IGNORE CRANKSHAFT AND COUNTERBALANCE DISASSEMBLY (**STEPS 2 THROUGH 6, PAGE 13-35**), IF THE LINK ROD OPPOSITE OF THE PTO SIDE PASSES INSPECTION (**FIGURE 13-77, PAGE 13-36**).

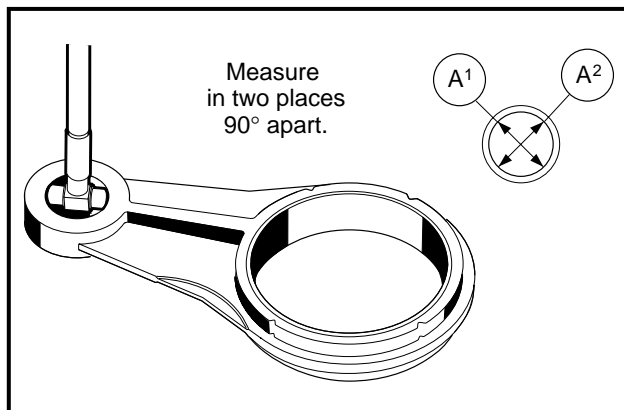


Figure 13-78 Measure Small Bore I.D.

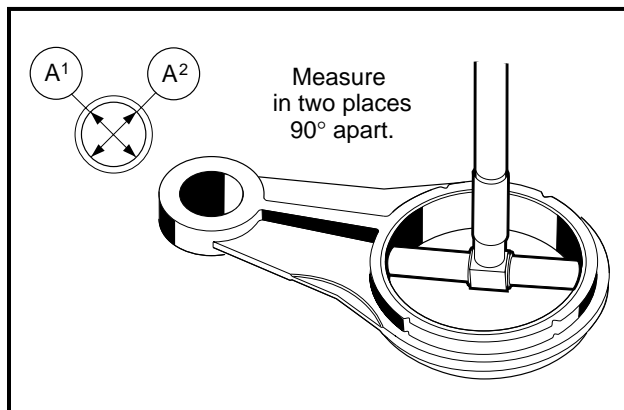


Figure 13-79 Measure Large Bore I.D.

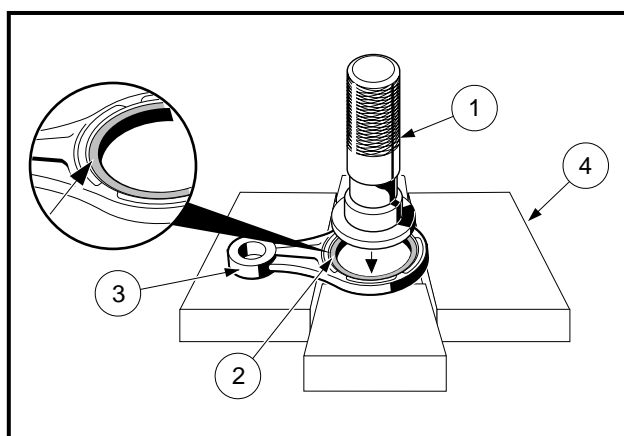


Figure 13-80 Remove Bearing From Link Rod

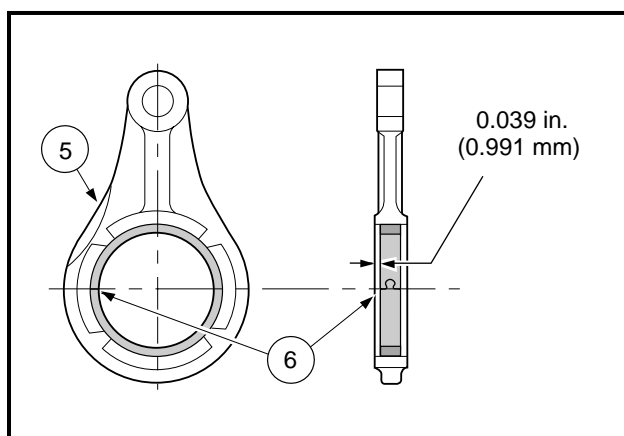


Figure 13-81 Install New Bearing Into Link Rod

Link Rod Bushing Replacement

1. Support the link rod around the entire large end, and using a 1.97 inches (50 mm) bearing driver (1), drive the bearing (2) out of the rod (3) as shown (**Figure 13-80, Page 13-37**).
2. Clean the parts thoroughly in a high flash-point solvent and dry them.
3. Coat the new bearing with new engine oil.
4. Using a 1.97 inches (50 mm) bearing driver, press the new bearing into the link rod with its seam (6) toward the side of the link rod with the hollow (5) and at right angles to the rod center, to a depth of 0.039 inch (0.991 mm) from the surface (**Figure 13-81, Page 13-37**).

COUNTERBALANCE WEIGHT

NOTE

- THE WRIST PINS ARE TIGHTLY PRESSED INTO THE WEIGHT AND NORMALLY REQUIRE NO MAINTENANCE.

Counterbalance Weight Inspection

1. Clean the inside of the bore surface and inspect it for wear or damage.
2. Using a telescoping gauge and micrometer, measure the inside diameter of the bearing bore. If the inside diameter is greater than 1.0283 inches (26.119 mm), or the bore show signs of wear or damage, replace counterbalance weight (**Figure 13-82, Page 13-38**).

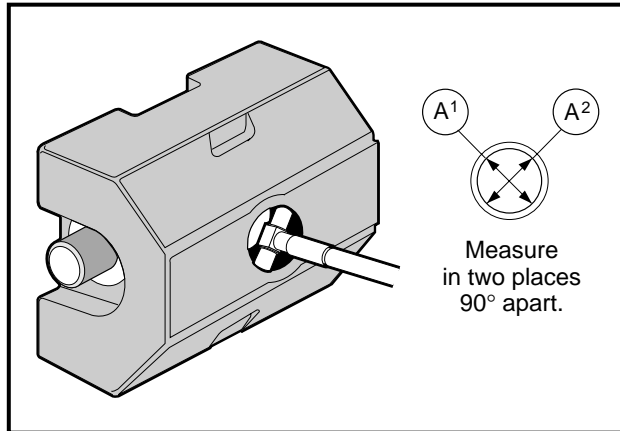


Figure 13-82 Measure I.D. of Counterbalance Weight Bore

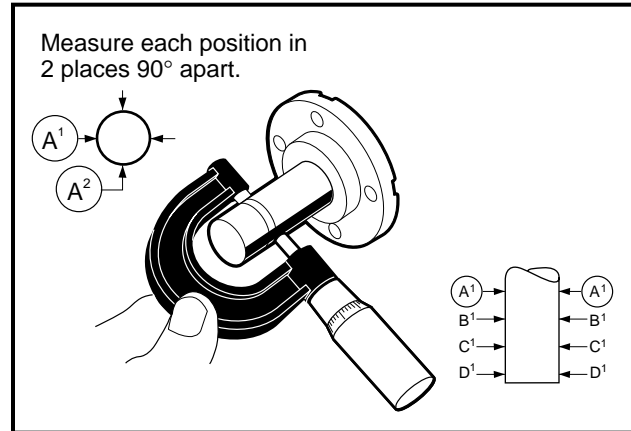


Figure 13-83 Measure O.D. of Counterbalance Guide Shaft

Counterbalance Guide Shaft Inspection

1. Clean the shaft surface and inspect it for wear or damage.
2. With an outside micrometer, measure the outside diameter of the guide shaft surface (**Figure 13-83, Page 13-38**).
3. If the outside diameter is smaller than 1.0199 inches (25.907 mm), or the shaft show signs of wear or damage, replace the guide shaft.
4. Check the O-Ring seal to make sure the O-Ring is not damaged. Replace if necessary.

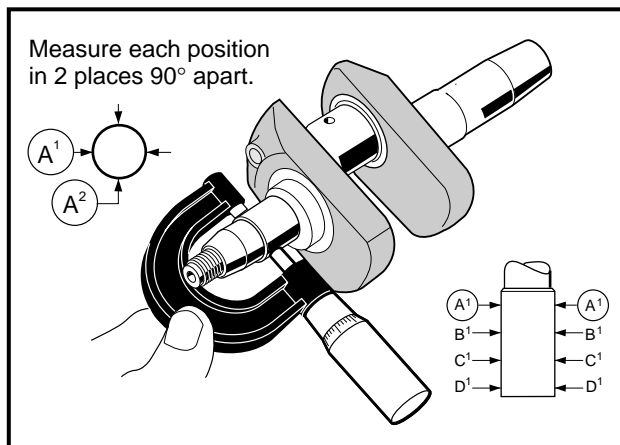


Figure 13-84 Measure Main Journals

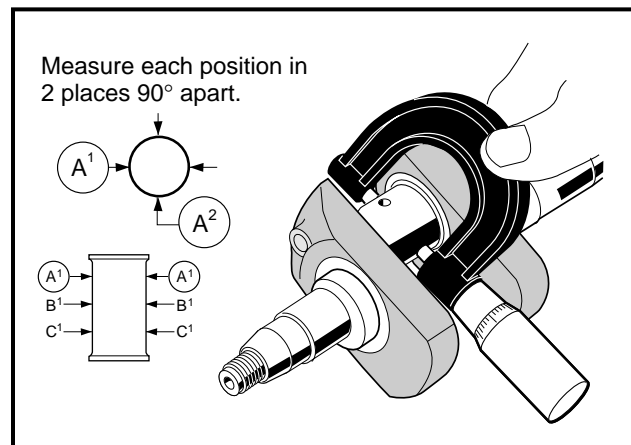


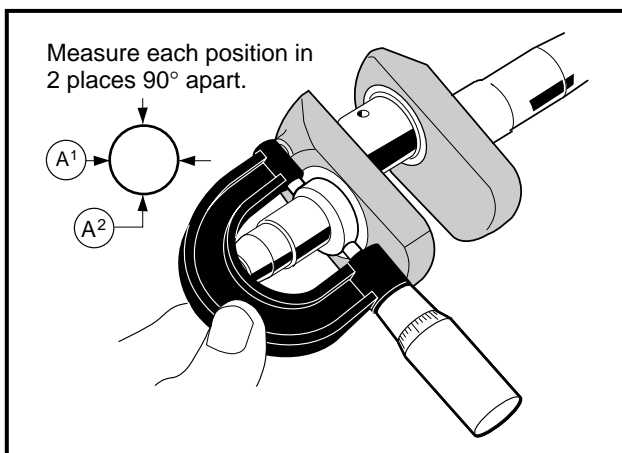
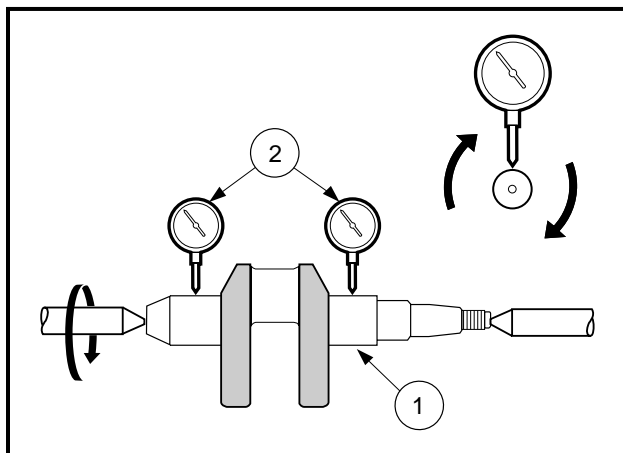
Figure 13-85 Measure Connecting Rod Journal

Crankshaft Inspection

1. Clean and inspect the journals for scoring. Inspect the crankshaft gear for cracks, scoring or broken teeth. Replace parts if necessary.
2. Using a micrometer, measure both main journals (PTO side and flywheel side) at several points along their lengths (**Figure 13-84, Page 13-38**).
 - 2.1. If either journal diameter is less than 1.1783 inches (29.929 mm), replace the crankshaft.
3. Using a micrometer, measure connecting rod journal at several points along its length (**Figure 13-85, Page 13-38**).
 - 3.1. If the journal diameter is less than 1.3954 inches (35.443 mm), replace the crankshaft.

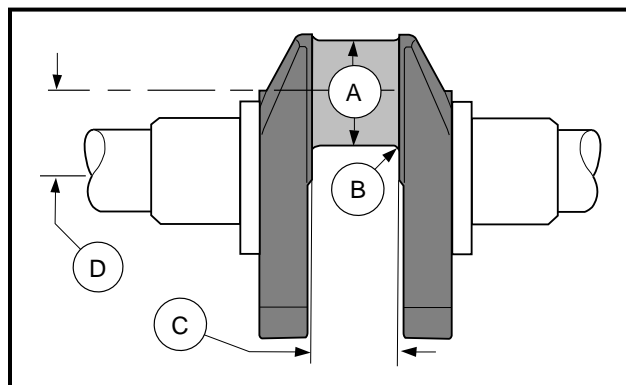
Crankshaft Inspection, Continued:

4. Using a micrometer, measure the crankshaft link rod journals at several points (**Figure 13-86, Page 13-39**).
 - 4.1. If the diameter of either journal is less than 1.8474 inches (46.924 mm), replace the crankshaft.
5. Check the crankshaft alignment.
 - 5.1. Place the crankshaft in an alignment jig.
 - 5.2. Turn the crankshaft (1) slowly and measure total indicated run-out at the location shown (2) (**Figure 13-87, Page 13-39**).
 - 5.3. If total run-out exceeds 0.002 inch (0.051 mm), replace the crankshaft.

**Figure 13-86 Measure Crankshaft Link Rod Journal****Figure 13-87 Measure Total Indicated Run-Out****Undersized Connecting Rod**

The connecting rod journal can accept an undersized connecting rod with a 1.3779 inches (35.0 mm) inside diameter. Grinding the crankshaft is required before using the undersized connecting rod.

1. Have a reliable repair shop grind the crankshaft journal (A) (**Figure 13-88, Page 13-39**).
2. The final finishing dimensions are as follows (**Figure 13-88, Page 13-39**).
 - (A) 1.3775 - 1.3779 inches (34.989 - 35.00 mm)
 - (B) 0.110 - 0.126 inch (2.80 - 3.20 mm) radius two places
 - (C) 1.12 inches maximum (28.4 mm)
 - (D) 1.1811 - 1.1831 inches (30.0 - 30.05 mm)
3. The connecting rod journal (A) must be concentric and cylindrical within 0.0002 inch (0.005 mm) at full indicator reading (**Figure 13-88, Page 13-39**).
4. Finish should be very smooth. Use a super fine finishing stone.

**Figure 13-88 Crankshaft Finishing Dimensions**

OIL SCREEN

Oil Screen Removal

1. Remove the two bolts (1) to take out the oil screen plate (2) and the oil screen (3) (**Figure 13-89, Page 13-40**).
2. Clean the oil screen thoroughly with a high flash-point solvent, then dry the screen.

Oil Screen Installation

1. To install the oil screen, reverse the removal procedure.
2. Tighten bolts to 30 in-lb (3.4 N·m).

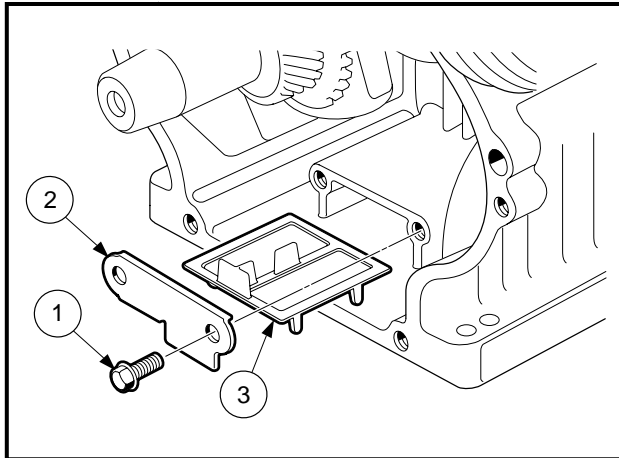


Figure 13-89 Oil Screen Removal

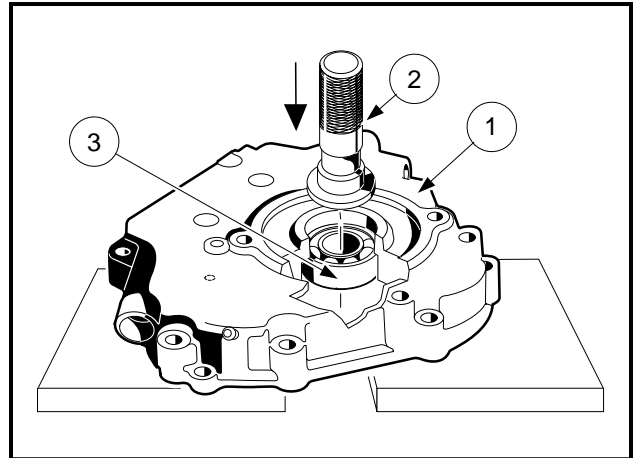


Figure 13-90 Ball Bearing Removal

BALL BEARING

Ball Bearing Removal

1. Remove the oil seal in the crankcase cover. **See following NOTE.**

NOTE

- NEVER REUSE AN OIL SEAL. REPLACE THE OIL SEAL WITH A NEW ONE.

2. Place the crankcase cover (1) on a bench with its outside up (gasket surface against bench) (**Figure 13-90, Page 13-40**).
3. Using a bearing driver (2) (Part of Club Car Bearing Driver Kit, Part No. 1016416), drive out the ball bearing (3) as shown.

Ball Bearing Inspection

1. Clean the ball bearing thoroughly in high flash-point solvent and dry it.

NOTE

- NEVER USE COMPRESSED AIR TO DRY BEARING. USE OF COMPRESSED AIR WILL RESULT IN PREMATURE BEARING FAILURE.

2. Spin the ball bearing by hand and check for (A) axial play and (B) radial play. Replace the ball bearing if it is noisy, does not spin smoothly, or if it has any play (**Figure 13-91, Page 13-41**).

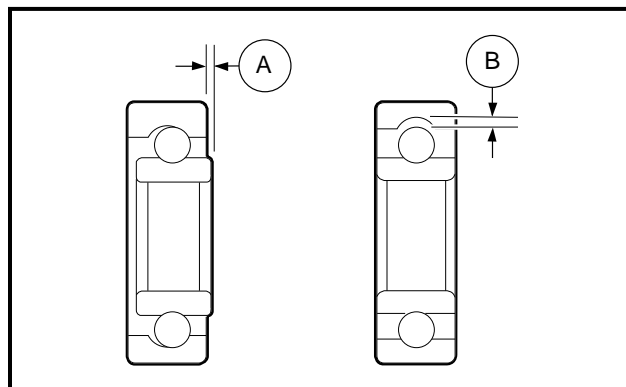


Figure 13-91 Check Ball Bearing

OIL SEALS

Oil seals are used on both ends of the crankshaft. Any time the crankshaft is removed from the seals, the seals must be replaced with new ones.

Oil Seal Removal

Use an oil seal remover to press or drive the seal out of the casing.

Oil Seal Installation

NOTE

- NEVER REUSE AN OIL SEAL. REPLACE THE OIL SEAL WITH A NEW ONE.

1. Put a light coating of clean engine oil on the outside edge and the inner lip of the oil seal to assist installation.
2. Install all oil seals with their lips facing the center of the engine.
3. Using the 1.37 inch (35 mm) seal driver, press the oil seal into the flywheel side of the crankcase until it is flush with the hole.
4. Using the 1.97 inch (50 mm) seal driver, press the oil seal into the crankcase cover until it is 0.157 inch (4 mm) below the outside surface.

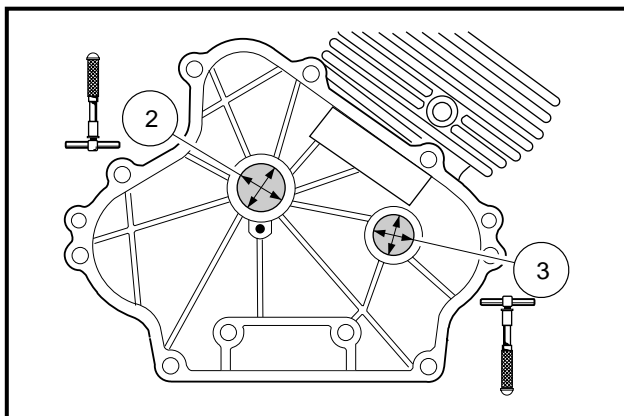


Figure 13-92 Inspect Bearing Surfaces in Crankcase

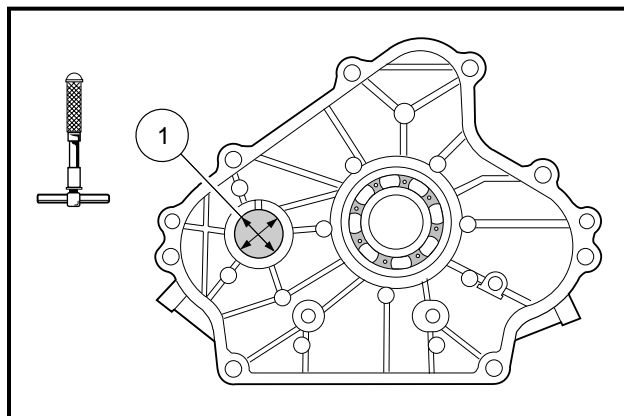


Figure 13-93 Inspect Camshaft Surface in Crankcase Cover

Plain Bearing Surface Inspection

Plain bearing surfaces are used for both ends of the camshaft and the flywheel end of the crankshaft.

1. Inspect the camshaft surfaces, one in the crankcase (3) (**Figure 13-92, Page 13-41**) (and the other in the crankcase cover (1) (**Figure 13-93, Page 13-41**)). Using an inside micrometer or telescoping gauge, measure the inside diameter of each bearing surface. If the inside diameter is greater than 0.9080 inch (23.063 mm), replace the crankcase and/or the crankcase cover.
2. Inspect the crankshaft bearing surface (2) in the crankcase. Using an inside micrometer or telescoping gauge, measure the inside diameter of the bearing surface. If the inside diameter is greater than 1.1841 inches (30.075 mm), replace the crankcase (**Figure 13-92, Page 13-41**).

Crankshaft Installation

Read **DANGER** and **WARNING** on page 13-1.

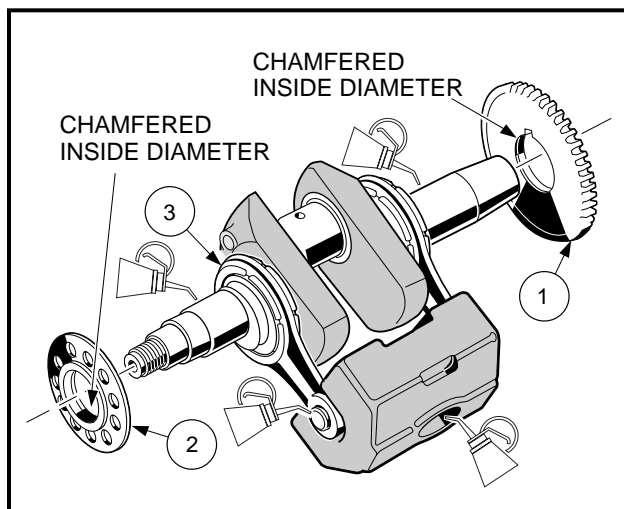


Figure 13-94 Crankshaft Assembly

⚠ CAUTION

- BEFORE ASSEMBLY, MAKE SURE ALL PARTS ARE CLEAN.

NOTE

- WHEN REASSEMBLING THE CRANKSHAFT AND THE COUNTERBALANCE WEIGHT, APPLY A LIGHT FILM OF ENGINE OIL TO THE CRANKSHAFT JOURNALS AND GUIDE SHAFT (**FIGURE 13-94, PAGE 13-42**).

1. Installation is the reverse of removal. **See Crankshaft and Counterbalance Removal, Page 13-35.**
2. Tighten the four nuts (2) for counterbalance guide shaft to 50 in-lb (5.9 N·m) (**Figure 13-73, Page 13-34**)
3. If the link rod was removed from the PTO side of the crankshaft, support the crankweb as shown, slide the link rod onto the crankshaft, and install the key. Press the spur gear and helical gear onto the crankshaft (**Figure 13-95, Page 13-43**) and (**Figure 13-96, Page 13-43**). **See following CAUTION and NOTE.**

Crankshaft Installation, Continued:**⚠ CAUTION**

- ALWAYS USE A PRESS WHEN REMOVING OR INSTALLING THE SPUR GEAR AND HELICAL GEAR ON THE CRANKSHAFT.
- IF THE SPUR GEAR WAS WARPED WHILE BEING REMOVED, INSTALL A NEW ONE.

NOTE

- MAKE SURE THE CHAMFERED INSIDE DIAMETERS OF THE SPUR GEAR AND HELICAL GEAR ARE ORIENTED DOWNWARD ON THE CRANKSHAFT AS SHOWN (**FIGURE 13-95, PAGE 13-43**).
- MAKE SURE THE LINK RODS ROTATE SMOOTHLY AFTER THE GEARS ARE PRESSED ON.

4. Slide the link rod, then the spacer, onto the flywheel end of the crankshaft.

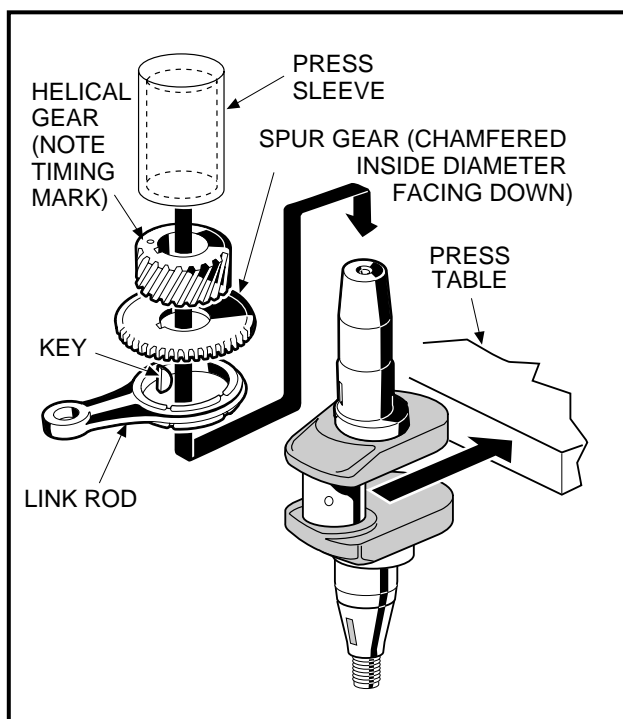


Figure 13-95 Crankshaft Installation

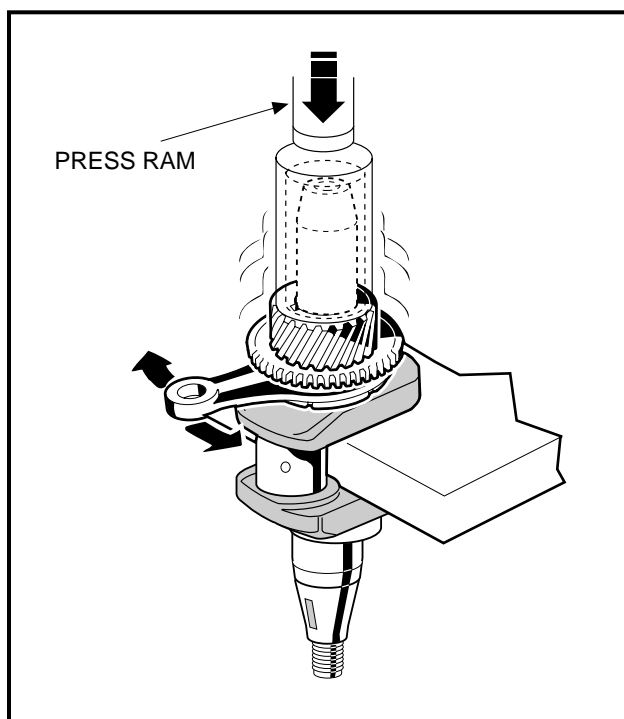


Figure 13-96 Press On Spur Gear and Helical Gear

PISTON AND CONNECTING ROD INSTALLATION

1. Reassemble the piston and the connecting rod into a unit, if disassembled.
 - 1.1. Align the arrow mark (1) on the piston head toward the words MADE IN JAPAN (2) on the connecting rod. Insert the piston pin through the piston holes and the connecting rod. Install the two retaining rings to hold the pin in place. The gap in the retaining rings should be facing towards the crankshaft. Make sure the retaining rings are seated in their grooves. Make sure the connecting rod moves freely (**Figure 13-97, Page 13-44**).

2. Apply a light film of engine oil to the connecting rod bearing surfaces and the two connecting rod bolts.
3. Put the piston and connecting rod into the cylinder bore with the lettering **MADE IN JAPAN** on the connecting rod oriented toward the PTO side of the engine. Position piston ring gaps so that they are oriented toward the corresponding letters in:
 - (A) Top Ring Gap
 - (B) Second Ring Gap
 - (C) Upper Side Rail Gap installed in the lowest ring groove
 - (D) Lower Side Rail Gap installed in the lowest ring groove
4. Compress the rings on the piston and finish sliding piston into the cylinder (**Figure 13-98, Page 13-44**).

NOTE

- THE LETTER **R** MARKED ON THE TOP TWO PISTON RINGS SHOULD BE FACING UP WHEN THE RINGS ARE INSTALLED.
- INSTALL THE CHROME-EDGED RING INTO THE TOP RING GROOVE.

5. Tighten the two connecting rod bolts to 16.5 ft-lb (23 N·m).

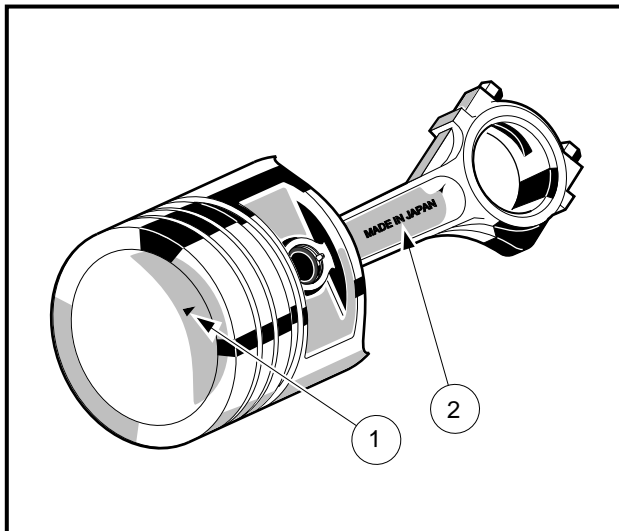


Figure 13-97 Piston/Connecting Rod

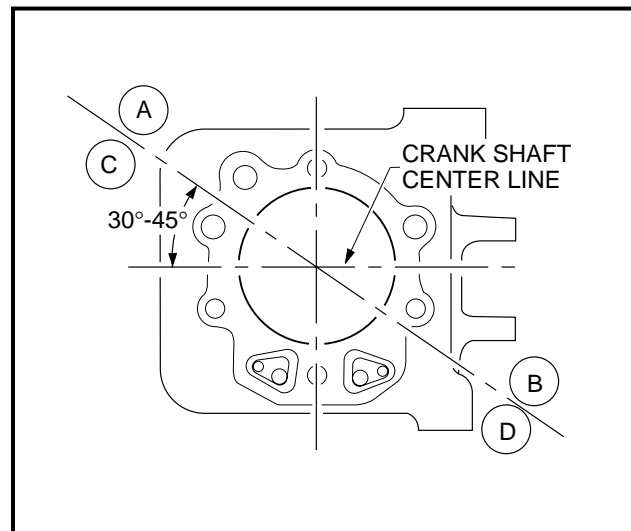


Figure 13-98 Position Piston Ring Gaps

CRANKSHAFT AXIAL PLAY ADJUSTMENT

See **DANGER** and **WARNING** on page 13-1.

1. With the gasket installed on the crankcase, measure from the gasket surface (1) to the helical gear surface (2). Record measurement (A) (**Figure 13-99, Page 13-45**).
2. Measure from the crankcase cover (3) mounting face to the crankshaft bearing inner end (4). Record measurement (B) (**Figure 13-99, Page 13-45**).
3. Locate the measurements on the Crankshaft Shim Table. Follow lines to where the recorded measurements intersect (**Figure 13-101, Page 13-45**).
4. Choose the next smaller shim from the table. Example: Measurement A is 15.87 mm and B is 17.66 mm. The correct crankshaft shim (5) is 1.53 mm.

Crankshaft Axial Play Adjustment, Continued:

5. Install the shim (5) on the crankshaft (6) (**Figure 13-100, Page 13-45**).

NOTE

- CRANKSHAFT SHIM SIZES FOR FE290 ENGINES RANGE FROM 1.13 TO 1.53MM.

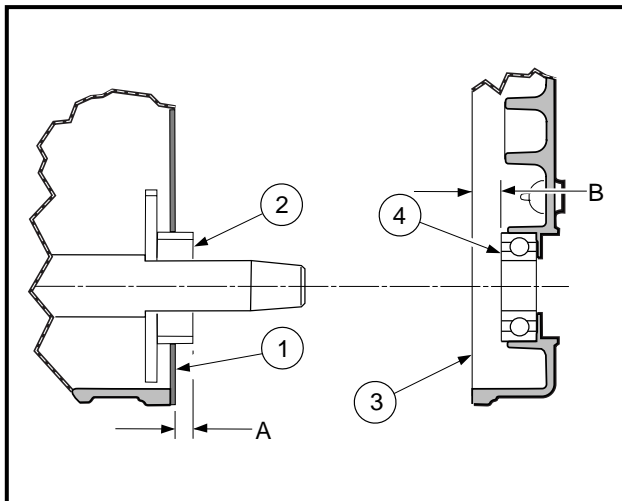


Figure 13-99 Determine Crankshaft Shim Size

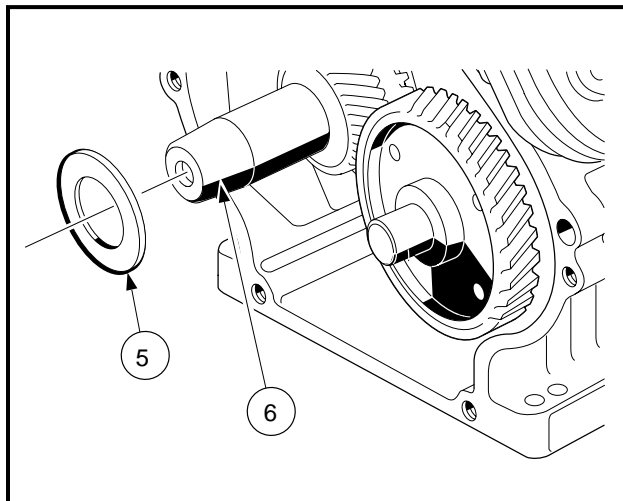


Figure 13-100 Install Shim on Crankshaft

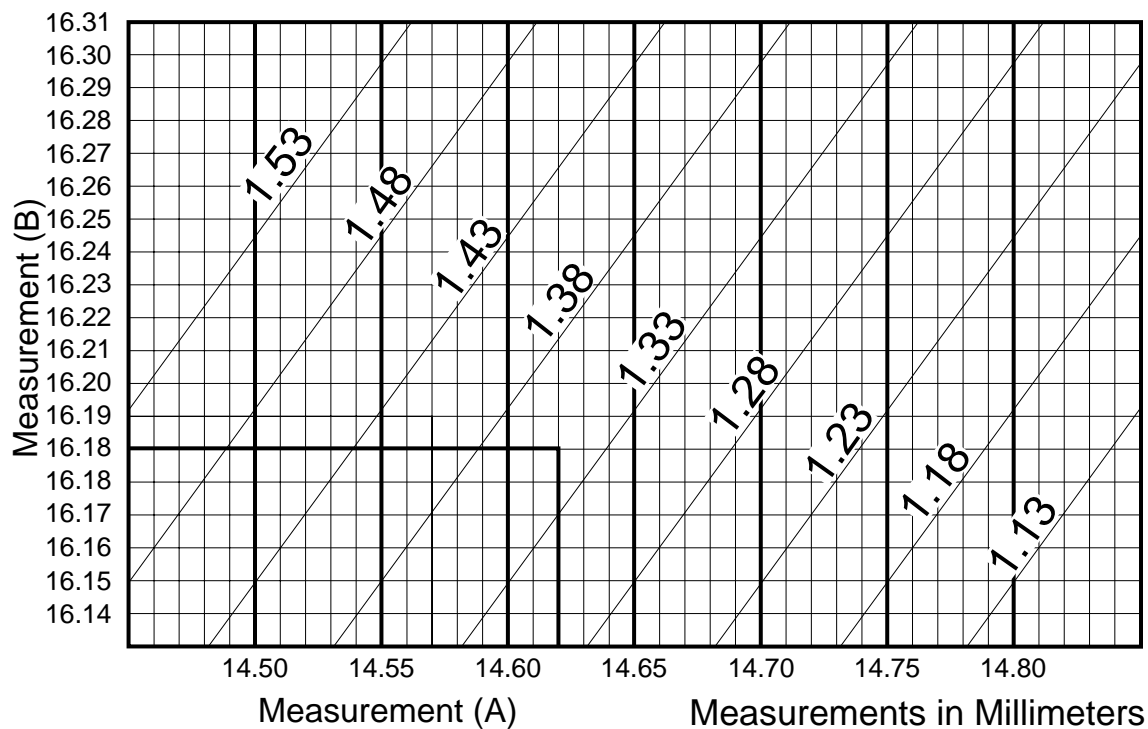


Figure 13-101 Crankshaft Shim Table

Camshaft Installation

⚠ CAUTION

- WHEN INSTALLING THE CAMSHAFT, MAKE SURE THAT THE TANG (1) ON THE OIL PUMP ROTOR SEATS IN THE SLOT (2) IN END OF THE CAMSHAFT (**FIGURE 13-103, PAGE 13-46**). IF THE OIL PUMP TANG IS NOT SEATED IN THE SLOT IN THE CAMSHAFT, SERIOUS ENGINE DAMAGE WILL RESULT.

1. Installation is the reverse of removal. **See Page 13-26.**

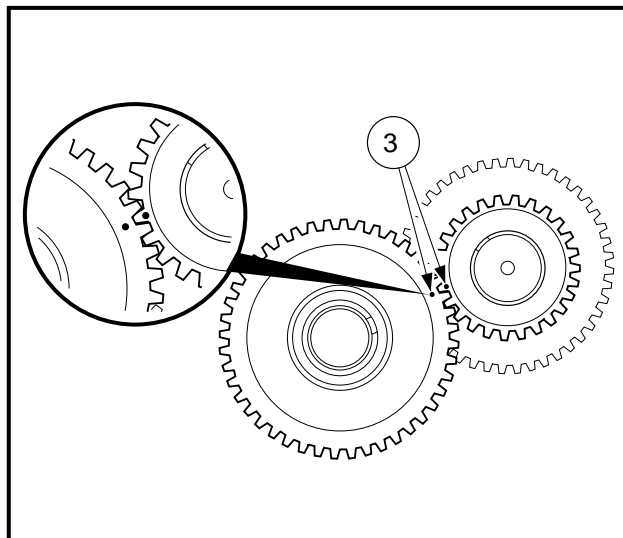


Figure 13-102 Align Timing Marks between Camshaft and Crankshaft

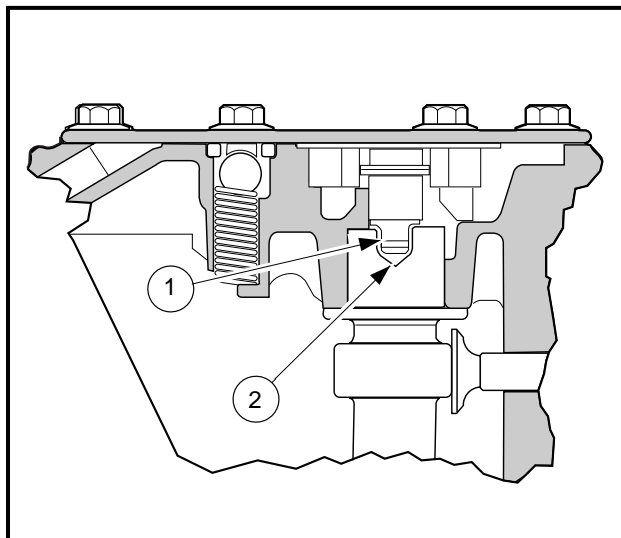


Figure 13-103 Proper Seating of Tang into Camshaft Slot

2. Apply a light film of engine oil to the camshaft journals and cam lobes.
3. Align the timing marks (3) (**Figure 13-102, Page 13-46**).

NOTE

- IF THE OUTSIDE EDGES OF THE CAMSHAFT AND CRANKSHAFT GEARS ARE NOT FLUSH, AND THE CRANKCASE COVER WILL NOT EASILY MAKE FULL CONTACT WITH THE CRANKCASE, MAKE SURE THE TANG ON THE OIL PUMP ROTOR IS SEATED IN THE CAMSHAFT SLOT.

CRANKCASE COVER INSTALLATION

⚠ CAUTION

- BEFORE ASSEMBLY, MAKE SURE PARTS ARE CLEAN.
- DO NOT REUSE THE GASKET. INSTALL A NEW ONE.
- INSTALL AND TIGHTEN CRANKCASE COVER BOLTS AS INSTRUCTED. FAILURE TO DO SO COULD CAUSE THE COVER TO BECOME WARPED.

Crankshaft Cover Installation, Continued:

1. Clean the gasket surfaces on the crankcase cover to fit a new gasket during installation and inspect the oil seal for wear and damage.
2. Install crankcase cover. Using **HANDS ONLY**, seat cover completely against the crankcase. If the cover will not seat, the camshaft is not installed correctly.
3. Install and finger tighten evenly the eight cover mounting bolts (**Figure 13-104, Page 13-47**).
4. Tighten the cover mounting bolts in two steps. First, in the sequence shown, tighten all eight bolts to approximately 130 in-lb (14 N·m). Then, repeating the sequence, tighten them to 250 in-lb (28.2 N·m) (**Figure 13-104, Page 13-47**).

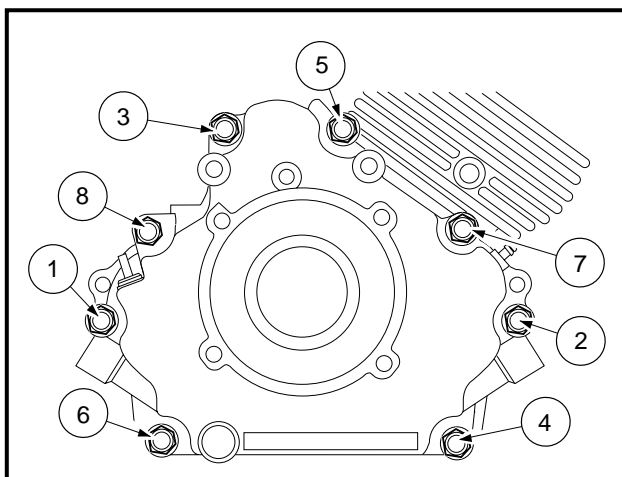


Figure 13-104 Crankcase Cover Installation

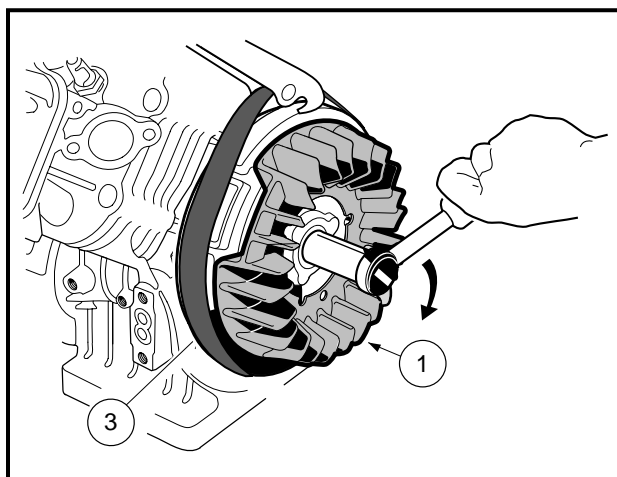


Figure 13-105 Fan and Flywheel Assembly

ENGINE ASSEMBLY

Read **DANGER** and **WARNING** on page 13-1.

⚠ CAUTION

- BEFORE ASSEMBLY, MAKE SURE PARTS ARE CLEAN.

1. Install cylinder head. **See Cylinder Head Installation, Page 13-20.**
2. Insert the flywheel key into the keyway in the crankshaft. Then align the keyway in the flywheel to the key and push the flywheel and fan assembly onto the crankshaft until it seats. Install flat washer and nut finger-tight.
3. Use a strap wrench (3) to keep the flywheel and fan assembly (1) from turning while tightening the flywheel nut to 63 ft-lb (85.4 N·m) (**Figure 13-105, Page 13-47**). **See following CAUTION.**

⚠ CAUTION

- THE FLYWHEEL NUT HAS RIGHT-HAND THREADS. TURN IT CLOCKWISE TO TIGHTEN, OR COUNTERCLOCKWISE TO LOOSEN.
- BE CAREFUL NOT TO DAMAGE THE FAN BLADES. USE A STRAP WRENCH TO HOLD FLYWHEEL. DO NOT PLACE SCREWDRIVER OR PRY BAR BETWEEN FAN BLADES.

4. Install ignition coil. **See Ignition Coil Installation, Page 13-32.**
5. Install cylinder head shrouds. Installation is the reverse of removal. **See Cylinder Shroud Removal, Steps 12 and 13, Page 13-10.**
6. Install carburetor. **See Section 14 – Fuel System.**
7. Place engine onto engine mounting plate and tighten hardware to 21 ft-lb (28.4 N·m). (**Figure 13-48, Page 13-25**).
8. Install drive clutch. **See Section 17 – Torque Converter.**
9. Install drive belt. **See Section 17 – Torque Converter.**
10. Install muffler. **See Section 15 – Exhaust System.**
11. Install starter/generator and belt. **See Section 12 – Electrical Components.**
12. Install the powertrain by performing steps 13 through 31, pages 16-35 through 16-38 in Section 16 – Unitized Transaxle.
13. Install oil drain plug in the crankcase and tighten to 20 ft-lb (27.1 N·m). Apply a light film of oil on the seal of a new oil filter and install the filter on the crankcase. Fill the crankcase to the proper level with the correct type of oil. This engine should be regarded as a new engine for next scheduled oil change. **See Section 10 – Periodic Maintenance.**
14. Check all hardware for proper torque/tightness.

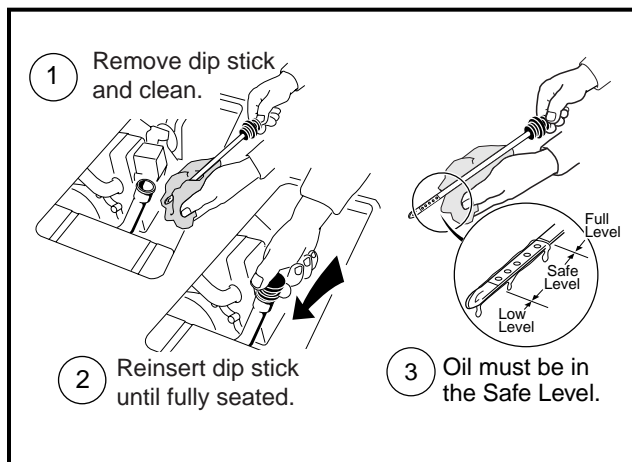


Figure 13-106 Check Engine Oil Level

15. Check engine oil level (**Figure 13-106, Page 13-48**).
 - 15.1. Vehicle should be on a level surface when checking oil. Do not overfill with oil.
16. Install a new or cleaned spark plug, gap 0.027 to 0.031 inch (0.686 to 0.787 mm), and connect plug wire to plug.
17. Connect battery cables, positive cable first and tighten terminals to 20 ft-lb (27.1 N·m).
18. Adjust engine RPM setting. **See Engine RPM Adjustment, Section 14 – Fuel System, Page 14-14.**
19. If initial checks indicate the engine is functional, place the neutral lock-out cam in OPERATE position.
20. Test-drive vehicle to ensure all systems are functional and correctly adjusted.

SERVICE SPECIFICATIONS

ITEM	SPEC.	SERVICE LIMIT
Crankshaft Axial Play		0.0137 inch (0.35 mm)
Crankshaft Crankpin Journal	O.D. (MIN.)	1.3954 inches (35.444 mm)
Crankshaft PTO-Side Journal	O.D. (MIN.)	1.1783 inches (29.930 mm)
Crankshaft Flywheel-Side Journal	O.D. (MIN.)	1.1783 inches (29.930 mm)
Crankshaft Balancer- Link-Rod Journals	O.D. (MIN.)	1.8474 inches (46.924 mm)
Camshaft Axial Play		0.0137 inch (0.35 mm)
Camshaft PTO-Side Journal	O.D. (MIN.)	0.9026 inch (22.927 mm)
Camshaft Flywheel-Side Journal	O.D. (MIN.)	0.9026 inch (22.927 mm)
Camshaft Cam Lobes (IN. and EX.)	O.D. (MIN.)	1.287 inches (32.70 mm)
Connecting Rod Big-End Bearing	I.D. (MAX.)	1.4003 inches (35.567 mm)
Connecting Rod Small-End Bearing	I.D. (MAX.)	0.7500 inch (19.051 mm)
Counterbalancer Rod Big-End Bearing	I.D. (MAX.)	1.8554 inches (47.126 mm)
Counterbalancer Rod Small-End Bearing	I.D. (MAX.)	0.4750 inch (12.064 mm)
Piston Top Ring Groove Clearance (with NEW ring)	(MAX.)	0.0063 inch (0.16 mm)
Piston Second Ring Groove Clearance (with NEW ring)	(MAX.)	0.0055 inch (0.14 mm)
Piston Oil-Ring Groove Clearance and End Gap		Visual inspection only
Piston Pin	O.D. (MIN.)	0.7470 inch (18.975 mm)
Piston Pin Hole	I.D. (MAX.)	0.7493 inch (19.033 mm)
Crankcase Cover Camshaft bearing	I.D. (MAX.)	0.9079 inch (23.063 mm)
Cylinder Bore	I.D. Standard	3.0700 to 3.0708 inches (77.980 to 78.000 mm)
Cylinder Bore	I.D. (MAX.)	3.0735 inches (78.067 mm)
Cylinder Bore (out of round)	(MAX.)	0.0022 inch (0.056 mm)
Crankshaft Bearing	I.D. (MAX.)	1.1841 inches (30.075 mm)
Camshaft Bearing	I.D. (MAX.)	0.9080 inch (23.063 mm)
Oil Pump Housing	I.D. (MAX.)	1.6050 inches (40.766 mm)
Oil Pump Housing	Depth (MAX.)	0.4004 inch (10.170 mm)
Oil Pump Shaft Bearing	I.D. (MAX.)	0.5028 inch (12.770 mm)
Rocker Shaft	O.D. (MIN.)	0.4704 inch (11.949 mm)
Rocker Arm Bearing	I.D. (MAX.)	0.4754 inch (12.074 mm)
Valve Seat Angle (IN. EX.)	Standard	45°
Valve Seat Width	Standard	0.0197 to 0.0433 inch (0.50 to 1.10 mm)
Valve Seat Width	(MAX.)	0.075 inch (1.9 mm)
Service Specifications Chart continued on next page...		

ITEM	SPEC.	SERVICE LIMIT
Valve Face Angle (IN. EX.)	Standard	45°
Valve Margin (IN. EX.)	(MAX.)	0.024 inch (0.6 mm)
Valve Clearance (IN. EX.)	Standard	0.0047 inch (0.12 mm)
Intake Valve Stem	O.D. (MIN.)	0.2728 inch (6.930 mm)
Exhaust Valve Stem	O.D. (MIN.)	0.2722 inch (6.915 mm)
Valve Guide Hole (Intake)	I.D. (MAX.)	0.2781 inch (7.065 mm)
Valve Guide Hole (Exhaust)	I.D. (MAX.)	0.2781 inch (7.065 mm)
Valve Spring (Free Length)	(MIN.)	1.2894 inches (32.75 mm)
Oil Pump Shaft	O.D. (MIN.)	0.4971 inch (12.627 mm)
Outer Rotor	O.D. (MIN.)	1.5932 inches (40.467 mm)
Outer Rotor Width	(MIN.)	0.3905 inch (9.92 mm)
Relief Valve Spring (Free Length)	(MIN.)	0.748 inch (19.0 mm)
Counterbalancer Weight Bearing	I.D. (MAX.)	1.0283 inches (26.118 mm)
Support Shaft	O.D. (MIN.)	1.0199 inches (25.907 mm)
Breather Reed Valve (Valve Tip Air Gap)	(MAX.)	0.008 inch (0.2 mm)
Valve Stem (IN. and EX.) (Stem Bend)	(MAX.)	0.0012 inch (0.03 mm)
Push Rod (Rod Bend)	(MAX.)	0.012 inch (0.30 mm)
Valve Guide (IN. and EX.)	I.D. Standard	0.2756 to 0.2762 inch (7.00 to 7.015 mm)

SPECIFICATIONS FOR RESIZING CYLINDER BORE

ITEM	OVER SIZE	LIMITS
Final Boring Bore Diameter	0.010 inch (0.25 mm) 0.020 inch (0.50 mm)	3.0791 to 3.0799 inches (78.210 to 78.230 mm) 3.0890 to 3.0898 inches (78.460 to 78.480 mm)
Final Bore Diameter	0.010 inch (0.25 mm) 0.020 inch (0.50 mm)	3.0799 to 3.0807 inches (78.230 to 78.250 mm) 3.0898 to 3.0906 inches (78.480 to 78.500 mm)

TORQUE SPECIFICATIONS

ITEM	SIZE	SPECIFICATIONS
Cylinder Head Bolts	M8	220 in-lb (24 N-m)
Valve Clearance Adjustment Nuts	M5	90 in-lb (10 N-m)
Connecting Rod Bolts (Coat Threads with Engine Oil)	M7	180 in-lb (20 N-m)
Flywheel Retaining Nut	M16	63 ft-lb (86 N-m)
Crankcase Cover to Block Bolts	M8	250 in-lb (28.3 N-m)
Torque Specifications continued on next page...		

ITEM	SIZE	SPECIFICATIONS
Starter/Generator Bracket to Block Bolts	M8	200 in-lb (23 N-m)
Oil Drain Plug	M14	20 ft-lb (27.1 N-m)
Fan Housing Screws	M6	90 in-lb (10 N-m)
Fan Shroud Screws	M6	25 in-lb (2.8 N-m)
Bolts Marked with "4" (When Used with Nuts)	M8	130 in-lb (15 N-m)
	M6	50 in-lb (5.9 N-m)
	M5	30 in-lb (3.4 N-m)

ADJUSTMENTS AND SETTINGS

ITEM	LIMITS
Spark Plug Gap (Standard)	0.027 to .031 inch (0.69 to 0.79 mm)
Ignition Coil Air Gap (Standard)	0.012 inch (0.304 mm)
Oil Pressure (MIN.) at fast idle speed	45.5 psi (314 kPa)
Oil Filter: bypass-valve opening pressure	11.4 to 17.0 psi (78 to 118 kPa)
Compression Pressure (MIN.)	156 psi (1076 kPa)
Crankcase Vacuum (MIN.) at governed speed	1.18 inches (30 mmHg)
Cylinder Head-Gasket Surface Flatness (MAX.)	0.002 inch (0.05 mm)
Valve Clearance (IN. and EX.) when engine is cold	0.006 inch (0.15 mm)
Engine RPM	2700 RPM \pm 30 (DS Golf Car, Villager 4) 2860 RPM \pm 30 (Turf 1, Carryall 1)

SECTION 14 – FUEL SYSTEM

DANGER

- **GASOLINE – FLAMMABLE! EXPLOSIVE! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM VEHICLE AND SERVICE AREA. SERVICE ONLY IN A WELL-VENTILATED AREA.**
- **DO NOT OPERATE VEHICLE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. THE ENGINE PRODUCES CARBON MONOXIDE, WHICH IS AN ODORLESS, DEADLY POISON.**

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR. FOLLOW ALL PROCEDURES EXACTLY AND HEED ALL WARNINGS STATED IN THIS MANUAL.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- TURN KEY SWITCH **OFF**, REMOVE THE KEY, AND PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- FRAME GROUND – DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRICAL WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR ANY OTHER METAL COMPONENT.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (–) FIRST.
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- FOR VEHICLES WITH CARGO BEDS, REMOVE ALL CARGO BEFORE RAISING THE BED. DO NOT CLOSE BED UNTIL ALL PERSONS ARE CLEAR OF CARGO BED AREA. KEEP HANDS CLEAR OF CRUSH AREA BETWEEN BED AND SEAT BACK SUPPORT. DO NOT DROP CARGO BED; LOWER GENTLY AND KEEP ENTIRE BODY CLEAR. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SEVERE PERSONAL INJURY.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, SET THE PARK BRAKE WHEN LIFTING THE FRONT OF THE VEHICLE, UNLOAD THE CARGO BED AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. USE APPROVED JACK STANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.

GENERAL INFORMATION

The engine is equipped with a float bowl type carburetor with fixed jets that require no adjustment. The carburetor atomizes the fuel, mixes it with air, and feeds the combustible mixture into the cylinder.

HOW THE CARBURETOR WORKS

MAIN SYSTEM

The main system of the carburetor consists of the main jet, the main nozzle, and the main air passage. The main system meters fuel to the engine during moderate to heavy load conditions. Fuel flows through the main jet and into the main nozzle, where it meets air from the main air passage. The resulting mixture flows out the end of the main nozzle and into the carburetor bore, where it is atomized by high-speed air flow and then carried into the engine (**Figure 14-1, Figure 14-2 and Figure 14-3**).

During the intake stroke of the engine, a negative pressure (vacuum) is created in the venturi of the carburetor. In this venturi tube, the intake air has high velocity and low static pressure. Subsequently, fuel is drawn out of the carburetor float chamber, atomized to fine particles, then drawn into the cylinder as a combustible mixture (**Figure 14-2, Page 14-2**).

Trouble in the main system is usually indicated by poor performance, or lack of power under heavy load conditions. A dirty or clogged main jet will cause the mixture to become too lean. An overly rich mixture could be caused by a clogged air passage, clogged air holes in the main nozzle, a loose main jet, or by a loose main nozzle.

If the engine exhibits symptoms of overly rich or lean fuel mix after all maintenance and adjustments are correctly performed, the main jet should be replaced. A smaller numbered jet gives a leaner mixture and a larger numbered jet gives a richer mixture. It is recommended that any change be limited to one jet size difference from the standard jet.

STANDARD JETTING

Pilot Air Screw	Middle of Travel
Pilot Jet	45 (x1/100)
Main Jet	82 (x1/100)
Throttle Valve Stop Screw	3/4 Turn Open

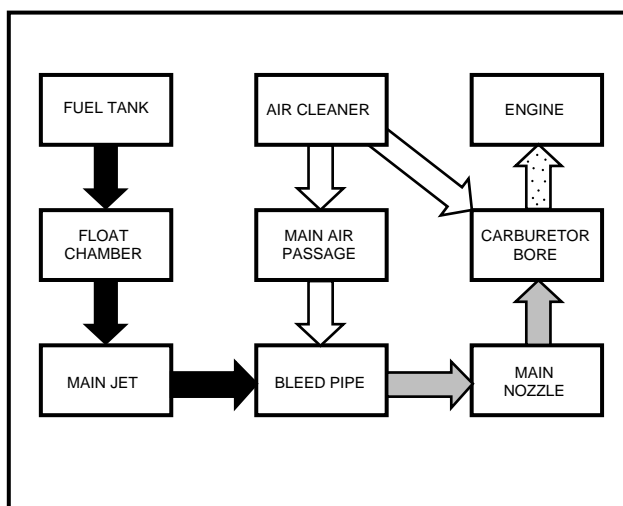


Figure 14-1 Fuel Flow Sequence

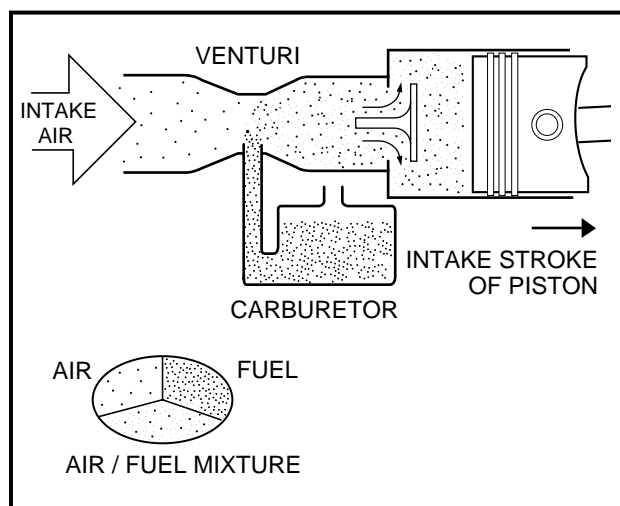


Figure 14-2 Air/Fuel Mixture

SLOW SPEED SYSTEM

The slow speed system supplies fuel during low speed running. Low speed running without load requires very low intake airflow. The throttle valve (2) (**Figure 14-3, Page 14-3**) is almost closed when this is the case, and as high negative pressure is created on the back side of the throttle valve, intake air is drawn in and metered through the pilot air jet. The intake air draws fuel, metered by the pilot jet (6) (**Figure 14-3, Page 14-3**),

from the carburetor float chamber. The combustible mixture of air and fuel is then delivered into the venturi through the pilot outlet and bypass. When the engine is operating at low speed, fuel is supplied mainly through the pilot outlet (**Figure 14-3, Page 14-3**).

The air/fuel mixture is adjusted by the pilot screw (needle valve) (**Figure 14-3, Page 14-3**).

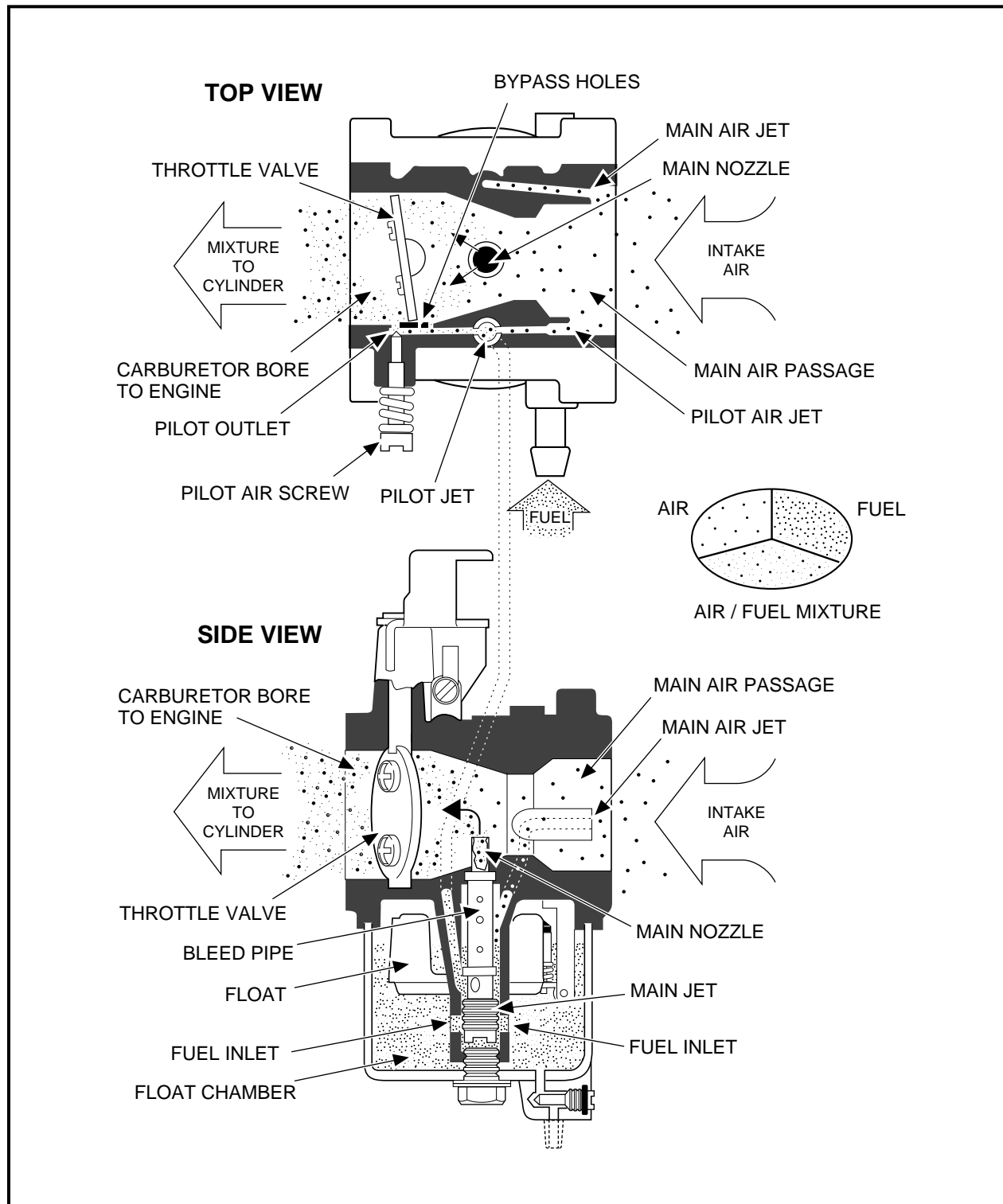


Figure 14-3 Carburetor

CHOKE AND FRESH AIR SYSTEM

The choke system aids in starting the engine in cold weather. When starting a cold engine, the spring-loaded choke cover (1) (**Figure 14-4, Page 14-4**) is pushed in by hand. This restricts the air flow to the venturi, causing a very high vacuum that draws fuel into the venturi at a high rate and thus creates a “fuel rich” mixture. The choke cover is held in until the engine starts, and then released.

An air duct provides the engine with clean, cool air from outside the engine compartment. This feature increases engine horsepower and greatly extends air filter life.

FLOAT SYSTEM

The carburetor is a float bowl type, with the float chamber located just below the carburetor body. The float system keeps the fuel in the float chamber at the correct level while the engine is running (**Figure 14-5, Page 14-4**).

Fuel is supplied to the carburetor float chamber by an external impulse pump that draws fuel from the fuel tank and through the fuel filters. The fuel then passes through the inlet valve (5) (**Figure 14-4, Page 14-4**) and into the float bowl. The fuel entering the bowl causes the float (4) (**Figure 14-4, Page 14-4**) to rise until it shuts off the inlet valve, preventing the fuel from exceeding a level predetermined by the float level setting.

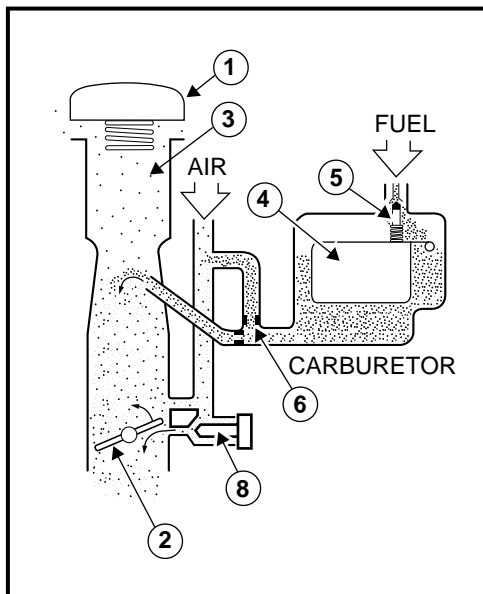


Figure 14-4 Choke System

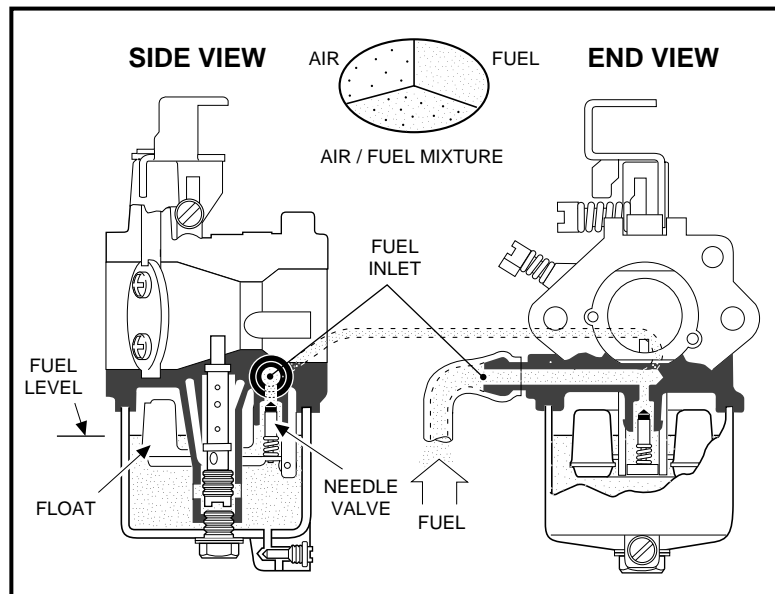


Figure 14-5 Float System

CARBURETOR

Read **DANGER** and **WARNING** on page 14-1.

Before suspecting the carburetor as the cause of poor engine performance, make sure the fuel and ignition systems are in proper operating condition. Check the following items:

- Spark Plug and Gap Condition. **See Section 13, Page 13-6.**
- Air Filter Element. **See page 14-16.**
- Fuel Filters. **See page 14-18.**
- Choke and Air Intake System (for restriction of air flow). **See page 14-14.**
- Fuel Pump. **See page 14-18.**
- Fuel Lines (from fuel tank to filter to pump to filter to carburetor). **See page 14-26.**
- Exhaust System (for restrictions). **See Section 15 – Exhaust System.**

If the carburetor floods or leaks fuel at the float bowl gasket or carburetor vent tube, the fuel inlet valve could be worn or dirty. Another cause of this condition may be a damaged float that has filled with fuel and sinks.

For elevations above 3000 feet, main jets other than standard operate more effectively. The following chart lists the elevation ratings for various jet sizes. No adjustment is required for the pilot jet. If the vehicle idles roughly, turn the pilot air screw (**Figure 14-3, Page 14-3**) out until the vehicle idles smoothly.

MAIN JET ELEVATION/SIZE CHART

ALTITUDE (FEET ABOVE SEA LEVEL)	FE290 ENGINE MAIN JET SIZE
0 - 3000	82
3000 - 5000	80
5000 - 8000	78
8000 - 10,000	75
10,000 AND OVER	72

CHANGING THE MAIN JET

1. Remove the carburetor.
 - 1.1. Remove the seat or raise the bed to gain access to the engine.
 - 1.2. Turn fuel shut-off valve on gas tank to the closed (OFF) position (**Figure 14-21, Page 14-26**).
 - 1.3. Loosen the air intake hose clamp (22) and disconnect the air intake hose (23) at the carburetor end only (**Figure 14-6, Page 14-6**).
 - 1.4. Remove the governor guard (5).
 - 1.5. Remove the governor cable cotter pin (25) and clevis pin (24) (carburetor end only).
 - 1.6. Disconnect the carburetor vent line (14).
 - 1.7. Disconnect the fuel supply line (26) at the carburetor end only. Temporarily plug the end of the fuel line to prevent fuel leakage.
 - 1.8. Remove the carburetor retaining nuts (19), intake pipe (17), and carburetor (12). **See following NOTE.**

NOTE

- NOTE THE ORIENTATION OF THE GASKET (16) BETWEEN THE CARBURETOR INTAKE (17) PIPE AND THE CARBURETOR BODY (12) SO THAT IT CAN BE REPLACED IN THE SAME ORIENTATION (**FIGURE 14-6, PAGE 14-6**).
- WHEN REMOVING THE CARBURETOR BODY, THE THROTTLE RETURN SPRING (11) MUST BE DISCONNECTED. NOTE ITS PROPER ORIENTATION SO THAT IT CAN BE REPLACED IN THE SAME ORIENTATION.
- THE CARBURETOR MUST BE KEPT UPRIGHT DURING REMOVAL.

2. Position the carburetor with the drain screw (11) over a catch basin (**Figure 14-7, Page 14-7**).
3. Turn the carburetor bowl drain screw counterclockwise two or three turns and drain all the fuel from the bowl into the catch basin (**Figure 14-7, Page 14-7**). Tighten the drain screw to 10 in-lb (1.1 N·m). Return fuel to the gas tank or dispose of properly.
4. Mark the body of the carburetor and the carburetor fuel bowl with an indelible ink marker so that, after removal, the bowl can be installed again in the same position (**Figure 14-7, Page 14-7**).
5. Remove the carburetor fuel bowl retaining screw and washer (12), then remove the fuel bowl (10) and clean it with a nonflammable solvent (**Figure 14-7, Page 14-7**). **See following NOTE.**

Changing the Main Jet, Continued:

NOTE

- MAKE SURE THE FUEL BOWL GASKET (9) REMAINS PROPERLY SEATED IN THE CARBURETOR BODY WHEN THE FUEL BOWL IS REMOVED (**FIGURE 14-7, PAGE 14-7**).
- DURING NORMAL OPERATION, THE FUEL BOWL RETAINS THE FLOAT PIVOT PIN (6). MAKE SURE THAT THE FLOAT PIVOT PIN DOES NOT FALL OUT OF THE CARBURETOR BODY AFTER THE FUEL BOWL IS REMOVED.

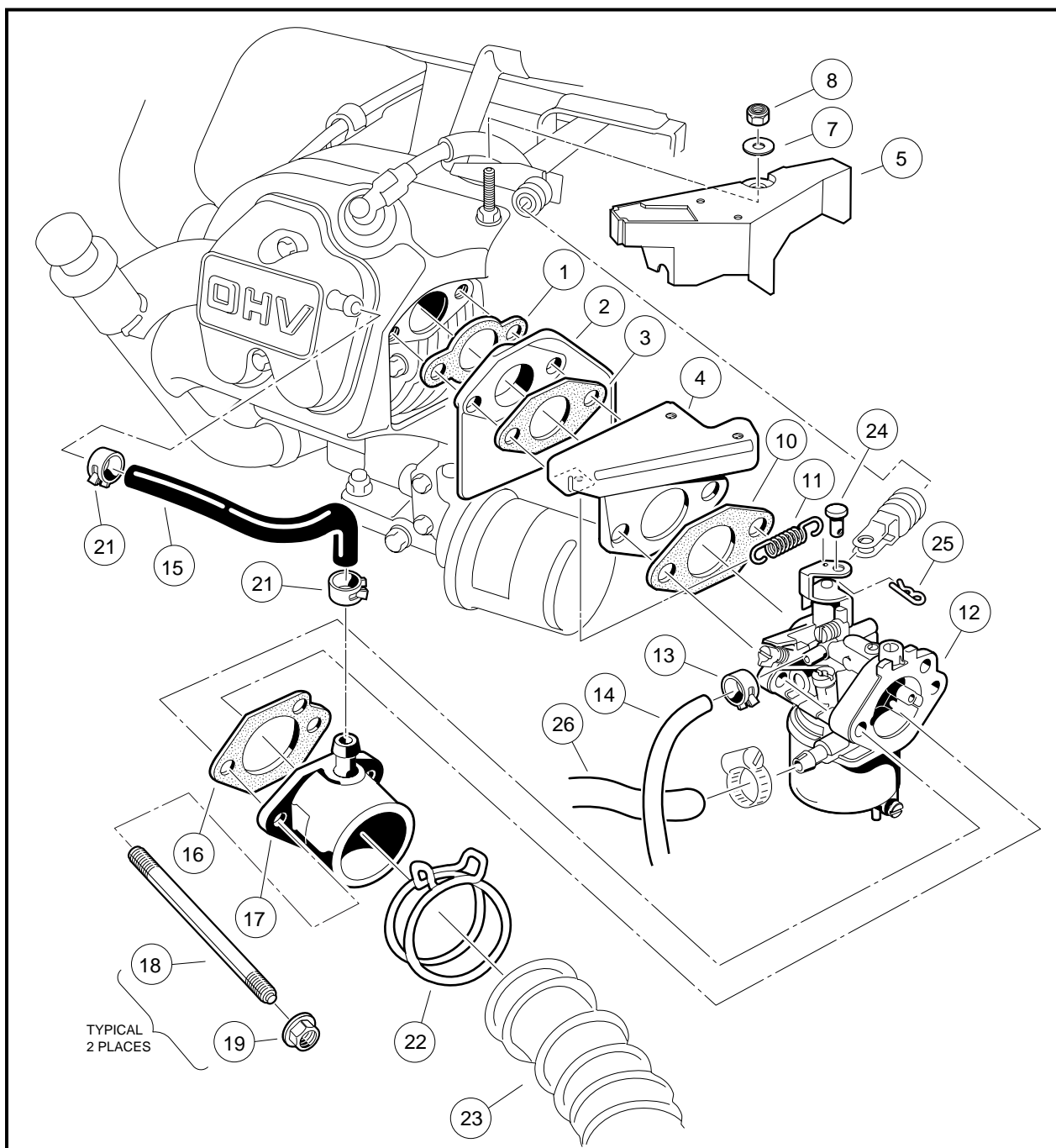


Figure 14-6 Carburetor Installation

6. Remove the main jet (8) from the carburetor body and discard it (**Figure 14-7, Page 14-7**).

NOTE

- MAKE SURE THE FUEL NOZZLE (7) DOES NOT FALL OUT OF THE CARBURETOR BODY AFTER REMOVAL OF THE MAIN JET. THIS IS BEST ACCOMPLISHED BY POSITIONING THE CARBURETOR UPSIDE DOWN DURING MAIN JET REMOVAL (**FIGURE 14-7, PAGE 14-7**).

7. Select the proper size main jet. **See chart on Page 14-5.** Check the size designation on the jet to make sure it is the correct part.
8. Install the new main jet and tighten it to 12 in-lb (1.4 N·m). **See following CAUTION and NOTE.**

CAUTION

- DO NOT REMOVE THE VALVE/SPRING ASSEMBLY FROM THE FLOAT ASSEMBLY. DOING SO WILL DAMAGE THE SPRING.

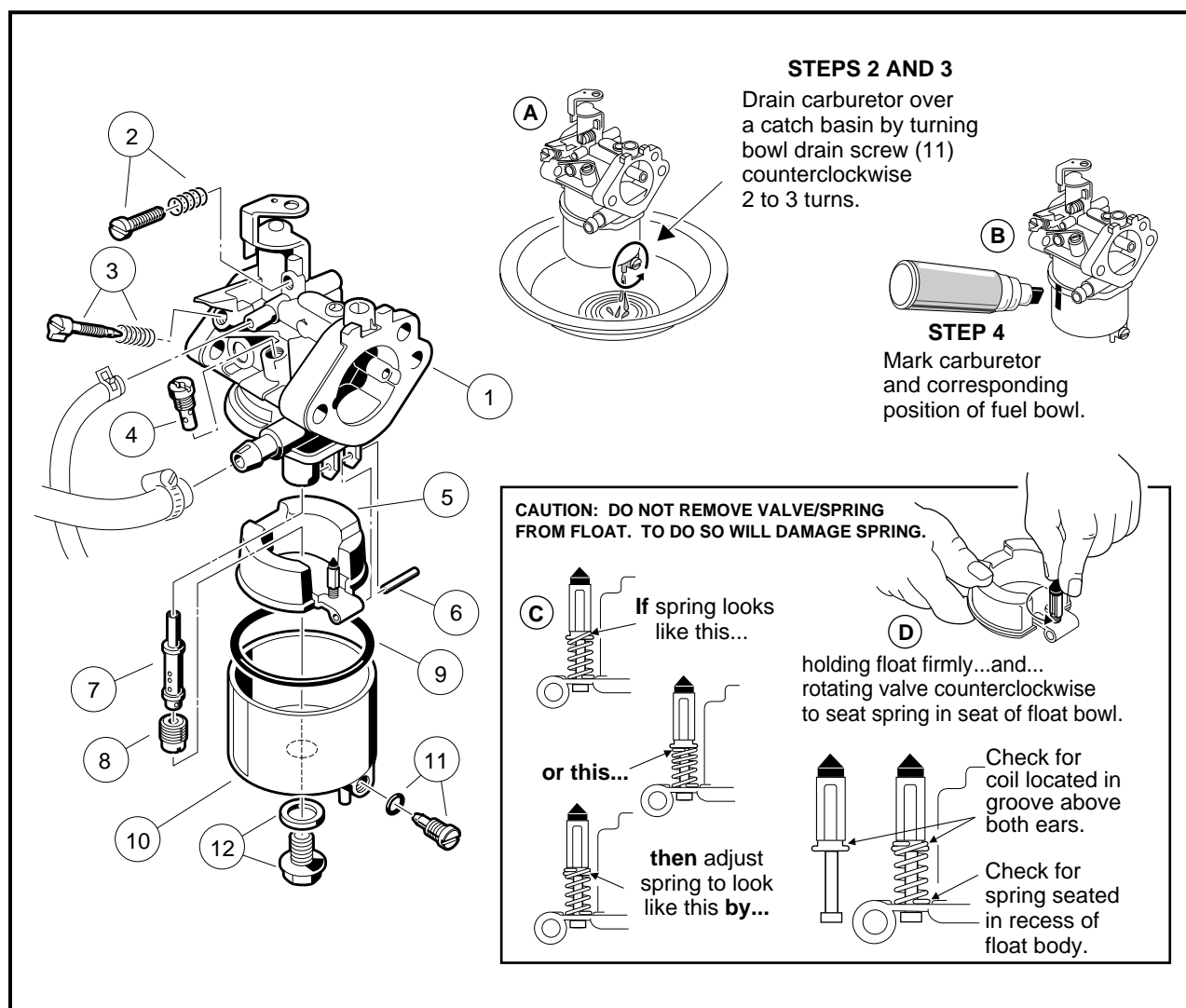


Figure 14-7 Changing the Main Jet

Changing the Main Jet, Continued:**NOTE**

- INSPECT THE MAIN JET NOZZLE (7), AND PILOT JET (4) TO ENSURE THEY ARE FREE FROM CONTAMINATION. REPLACE ANY PART THAT IS CLOGGED WITH CONTAMINATION. REPLACE THE FLOAT IF IT IS DAMAGED, OR IF THE FLOAT VALVE IS DAMAGED OR WORN. EXAMINE THE FLOAT VALVE/SPRING ASSEMBLY TO MAKE SURE THE SPRING IS INSTALLED CORRECTLY (**FIGURE 14-7, PAGE 14-7**).

9. Install the fuel bowl. Make sure that it is positioned properly by aligning the marks applied in Step 4. **See following CAUTION.**

CAUTION

- MAKE SURE THE FUEL BOWL IS PROPERLY SEATED AGAINST THE CARBURETOR FUEL BOWL GASKET, AND THE GASKET IS NOT PINCHED.

10. Install the fuel bowl retaining screw and tighten it to 61 in-lb (6.9 N·m).
11. Write the size of the main jet on the fuel bowl with an indelible ink marker. This should be written in a location that will be visible when the carburetor is installed on the engine.
12. Install the carburetor on the engine (**Figure 14-6, Page 14-6**).
 - 12.1. Attach the throttle return spring (11) to the carburetor and then to the throttle bracket (4) just before positioning the carburetor and securing it to the engine.
 - 12.2. Install the intake pipe gasket (16) (check for proper orientation) and intake pipe (17).
 - 12.3. Install the carburetor retaining nuts (19) and tighten them to 50 in-lb (5.7 N·m).
13. Connect fuel supply line (26) and tighten screw clamp to 9 in-lb (1.0 N·m) (if equipped) (**Figure 14-6, Page 14-6**).
14. Install carburetor vent line (14) and clamp (13).
15. Install the governor cable clevis pin (24) and cotter pin (25).
16. Install the governor guard (5), flat washer and nylon locknut. Tighten to 30 in-lb (3.4 N·m).
17. Install the intake hose (23) and secure with a hose clamp.

NOTE

- MAKE SURE THE INTAKE HOSE IS NOT TWISTED DURING INSTALLATION.

18. Turn fuel shut-off valve (on gas tank) to the ON position (**Figure 14-22, Page 14-26**).
19. Connect the battery cables, positive (+) post first, and tighten terminals to 20 ft-lb (27.1 N·m).
20. Test-drive the vehicle.

ENGINE CONTROL LINKAGE

Read Danger and Warning on page 14-1.

GENERAL INFORMATION

For proper vehicle operation, it is important the accelerator pedal, governor linkage, and throttle adjustments are done correctly and in the proper sequence. **See following CAUTION.**

⚠ CAUTION

- IMPROPER ADJUSTMENT CAN RESULT IN POOR VEHICLE PERFORMANCE AND/OR DAMAGE TO THE ENGINE COMPONENTS.

ACCELERATOR ROD**⚠ DANGER**

- TO ENSURE THE VEHICLE DOES NOT RUN OVER YOU WHILE YOU DISCONNECT OR ADJUST THE ACCELERATOR PUSH ROD, DO THE FOLLOWING:
 - TURN KEY SWITCH OFF, PLACE FORWARD/REVERSE HANDLE IN THE NEUTRAL POSITION, AND REMOVE KEY BEFORE SERVICING THE VEHICLE.
 - DISCONNECT BATTERY CABLES, NEGATIVE (–) FIRST.
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.

Accelerator Rod Removal

1. Raise the front of the vehicle. Place chocks at the rear wheels and lift the front of the vehicle with a chain hoist or floor jack. Place jack stands under the round frame cross tube to support the vehicle. **See DANGER above. See also WARNING on Page 14-1.**
2. Remove the accelerator rod by disconnecting the ball joint (1) from the ball stud (2) on the accelerator pedal (Figure 14-8, Page 14-9) and from the bell crank at the electrical box (Figure 14-11, Page 14-11).

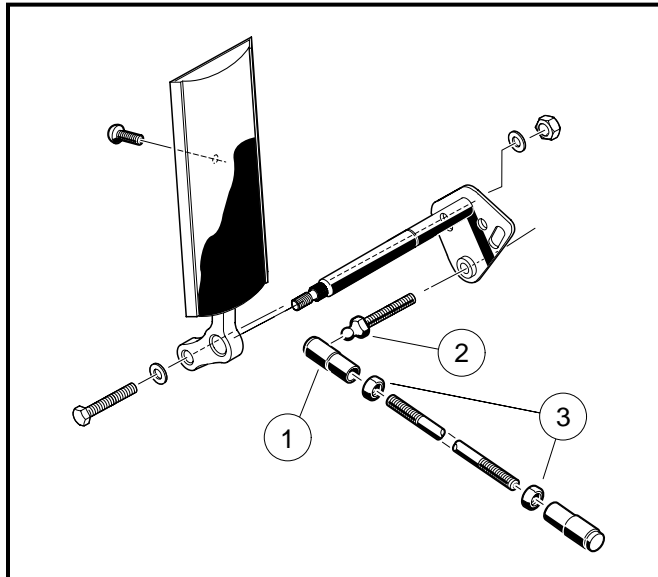


Figure 14-8 Accelerator Rod

Accelerator Rod Installation and Adjustment

1. Before installing the accelerator rod, adjust accelerator pedal position. **See Section 5 – Accelerator and Brake Pedal Group in the appropriate maintenance and service manual.**
2. Install the ball joint on the ball stud at the accelerator pedal (Figure 14-8, Page 14-9).
3. Remove seat or lift bed to access engine compartment.
4. Remove the electrical box cover (Figure 14-9, Page 14-10).

Accelerator Rod Installation and Adjustment, Continued:

5. Adjust length of accelerator rod:

- For the DS vehicle, with the ball joint jam nuts (3) (**Figure 14-8, Page 14-9**) loose, adjust the length of the accelerator rod to obtain a throttle cable cam position of 15-17° as shown (**Figure 14-9, Page 14-10**).
- For Turf 1, Carryall 1, and Villager 4 vehicles, with the ball joint jam nuts (3) loose (**Figure 14-8, Page 14-9**), adjust the length of the accelerator rod to obtain a throttle cable cam position of 0° as shown (**Figure 14-10, Page 14-10**).

CAUTION

- BE SURE THAT APPROXIMATELY AN EQUAL NUMBER OF THREADS IS EXPOSED AT EACH END OF THE ACCELERATOR ROD.

6. Install the accelerator rod on the bell crank ball joint on the electrical box (**Figure 14-11, Page 14-11**).**CAUTION**

- INSPECT THE LIMIT SWITCH INSIDE THE ELECTRICAL BOX. IF THE LIMIT SWITCH LEVER IS BENT, REPLACE THE SWITCH.

7. Before tightening the jam nuts, set the park brake to the first latch and pawl position and check for proper activation of switches.

8. While pressing the accelerator pedal, the following events should occur in *exactly the order shown*:

EVENT	APPROXIMATE PEDAL TRAVEL
Park Brake Release	0° - 4°
Solenoid Activation	4° - 8°
Carburetor Throttle Actuation	8° - 12°

9. While holding the accelerator ball joint with pliers, tighten the jam nuts against the ball joints, accelerator ball joint first, at each end of the accelerator rod.

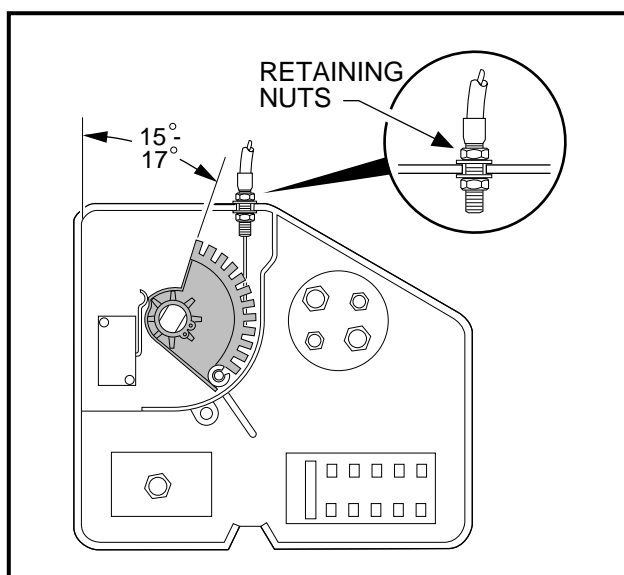


Figure 14-9 DS Golf Car Cam Position

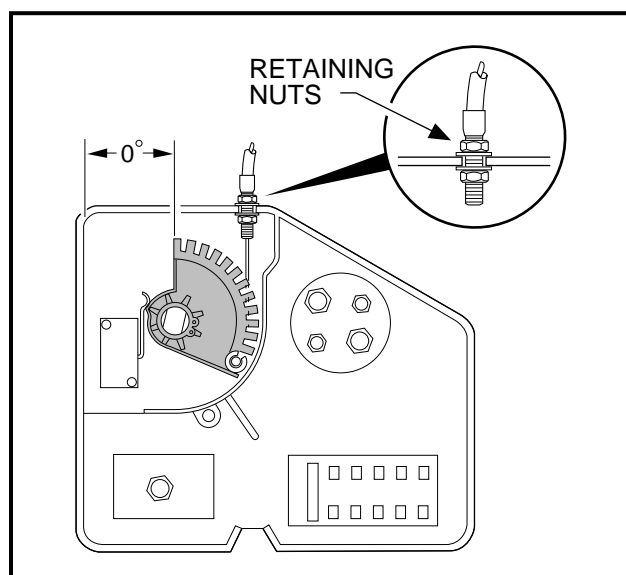


Figure 14-10 Turf 1, Carryall 1 and Villager 4 Cam Position

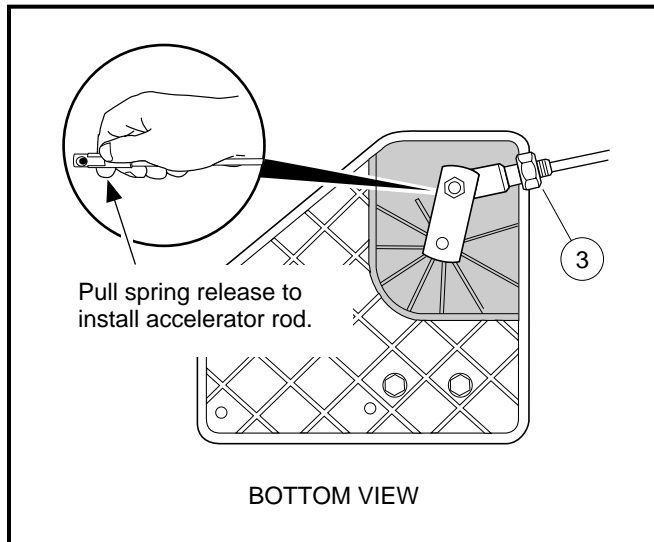


Figure 14-11 Accelerator Rod

10. Again check rod adjustment for proper switch activation.
11. After the pedal group and accelerator rod are properly adjusted, adjust the engine RPM setting. **See Engine RPM Adjustment, Page 14- 14.**
12. Install the electrical box cover and tighten retaining screw.

GOVERNOR CABLE

Governor Cable Removal

1. Remove seat or lift bed to access engine compartment.
2. Remove the governor guard (5) **(Figure 14-6, Page 14-6)**.
3. Remove the cotter pin (25) and clevis pin (24) at the carburetor throttle bracket **(Figure 14-6, Page 14-6)**.
4. Remove the E-ring (7) at the governor cable engine bracket (11), and governor cable support bracket (10) **(Figure 14-12, Page 14-12)**.
5. Remove the cotter pin (9) and clevis pin (8) from the governor lever arm (15) **(Figure 14-12, Page 14-12)**.
6. Remove the cable (2) **(Figure 14-12, Page 14-12)**.

Governor Cable Installation and Adjustment

1. Install the cable onto the governor cable support bracket (10) and the engine bracket (11) and attach an E-ring (7) at each end **(Figure 14-12, Page 14-12)**.
2. Push the cable dust shields onto the ends of the cable conduit.
3. Install the clevis pin (8) and cotter pin (9) through the clevis and carburetor throttle at the carburetor **(Figure 14-12, Page 14-12)**.
4. Install the clevis pin (8) and cotter pin (9) through the rear clevis and governor lever arm.
5. With the governor lever arm loose on the governor shaft, use a 1/8 inch punch or scratch awl to turn the governor arm shaft counterclockwise until it stops. Then pull the governor lever arm rearward until the carburetor throttle is in the "wide open throttle" (WOT) position.
6. While holding the arm and shaft in the fully counterclockwise position, tighten the governor arm lever nut to 36 in-lb (4.0 N·m).
7. Check the engine RPM adjustment. **See Engine RPM Adjustment, Page 14- 14.**

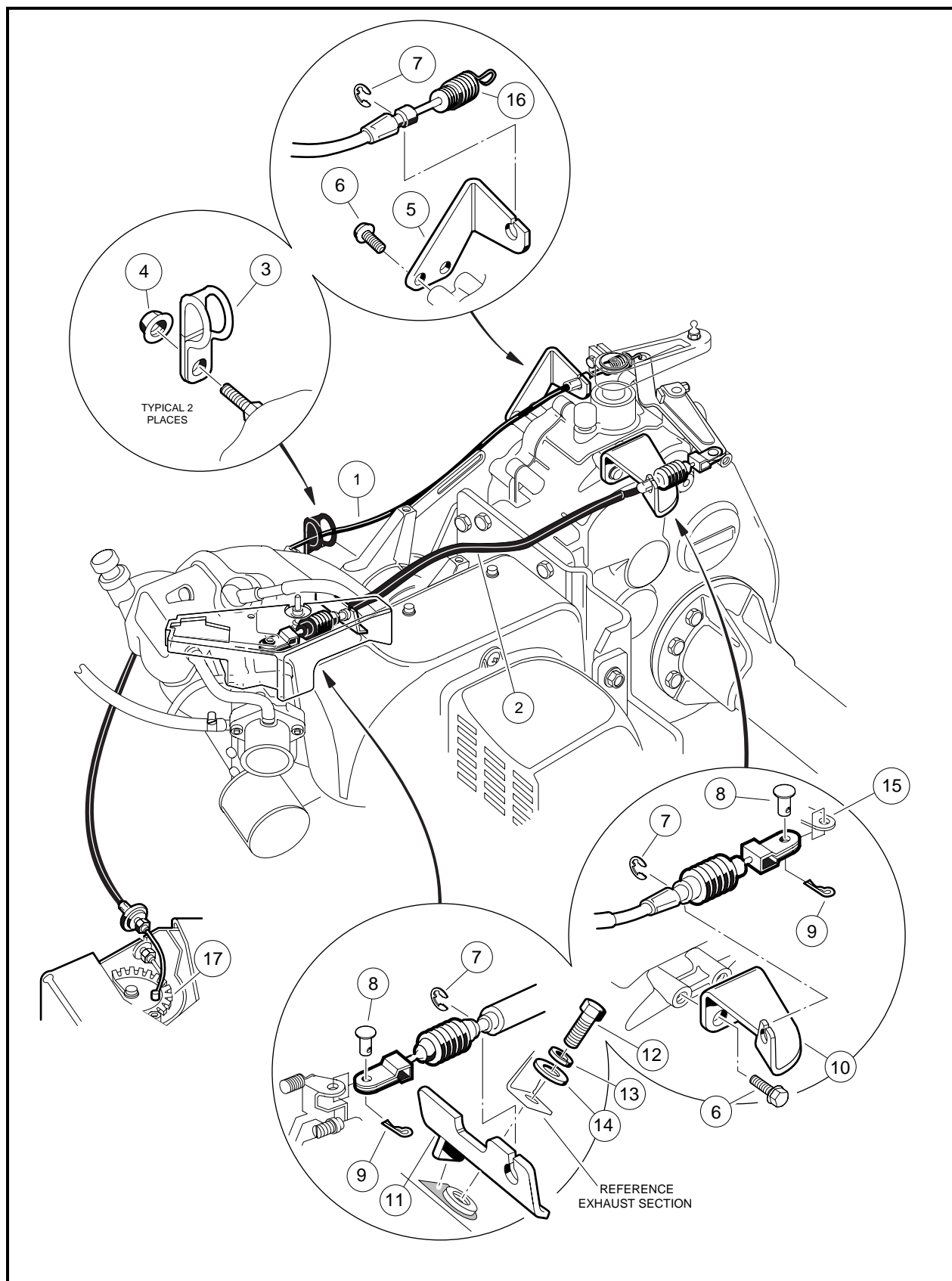


Figure 14-12 Governor and Accelerator Cables

ACCELERATOR CABLE

Accelerator Cable Removal

1. Remove seat or lift bed to access engine compartment.
2. Remove the electrical box retaining screw and cover and loosen the cable housing retaining nuts. **See Figure 14-9 or 14-10, Page 14-10.**
3. Disconnect cable (1) (**Figure 14-12, Page 14-12**) from cam in the electrical box.
4. Remove the E-ring (7) on the spring end of the cable at the accelerator cable bracket (5) (**Figure 14-12, Page 14-12**). Pull the cable housing out of the bracket.
5. Disconnect the spring (16) from the engine governor arm by rotating the arm counterclockwise one-half turn. Remove the cable assembly from the vehicle (**Figure 14-12, Page 14-12**).

Accelerator Cable Installation

1. Connect the cable to the cam (17) in the electrical box.
2. Insert the cable housing into the mounting slot in the wall of the electrical box, with approximately the same number of threads visible between the jam nuts as are visible from the nut inside the box to the end of the cable housing (**Figure 14-9 or Figure 14-10, Page 14-10**). Tighten the nuts finger tight.
3. Connect the spring (16) to the engine governor arm (**Figure 14-12, Page 14-12**).
4. Install cable in accelerator cable bracket(s) and secure it with E-ring (7) (**Figure 14-12, Page 14-12**).
5. Push the cable dust shield onto the spring end of the cable conduit (**Figure 14-12, Page 14-12**).
6. Before tightening the cable housing retaining nuts, make sure the engine RPM adjustment is correct. **See Engine RPM Adjustment, Page 14-14.**
7. Install the electrical box cover and tighten retaining screw.

CLOSED THROTTLE OR IDLE ADJUSTMENT

When the accelerator pedal is released, the engine will stop. Therefore, it is not possible to measure or set idling speed under normal vehicle operating conditions. Set throttle valve as follows:

1. Loosen the carburetor idle screw so that it is not touching the throttle lever (**Figure 14-13, Page 14-13**).
2. Slowly tighten the idle screw until it lightly touches the throttle lever, then tighten it an additional 3/4 turn.

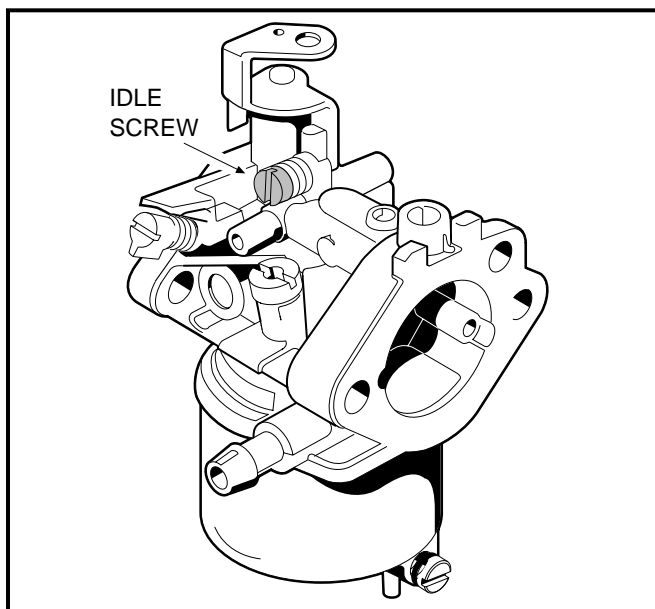


Figure 14-13 Idle Screw

ENGINE RPM ADJUSTMENT

DANGER

- **THE ENGINE PRODUCES CARBON MONOXIDE, WHICH IS AN ODORLESS AND DEADLY POISON. DO NOT OPERATE THE ENGINE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION.**

1. If the governor is adjusted, proceed to step 2; otherwise, adjust the governor. **See Governor Cable Installation and Adjustment, Page 14- 11.**
2. Connect the battery cables, positive (+) cable first. Tighten terminals to 20 ft-lb (27.1 N·m).
3. Place the Forward/Reverse handle in the NEUTRAL position and place the neutral lockout cam in the SERVICE position.
4. Connect a tachometer (Club Car Part No. 1016112) to the spark plug lead.
5. With the tachometer connected and the engine at normal operating temperature, check high-speed RPM. With the accelerator pedal pressed to the floor, the tachometer should read:
 - DS Golf Car: 2700 ±30 RPM
 - Carryall/Turf 1: 2860 ±30 RPM
 - Villager 4: 2700 ±30 RPM
6. To **reduce** RPM, loosen the accelerator cable retaining nut on the outside of the electrical box wall and tighten the retaining nut on the inside of the wall until the desired rpm is reached (**Figure 14-9, Page 14-10**) or (**Figure 14-10, Page 14-10**). To **increase** RPM, loosen the cable retaining nut inside the electrical box and tighten the nut outside the box until the desired rpm is reached.
7. Be sure both retaining nuts are locked against the electrical box and then check the rpm again. If the RPM needs to be adjusted, repeat step 6.
8. If more adjustment is required than the cable housing will allow, make sure the spring on the other end of the accelerator cable is properly positioned. Excessive belt and torque converter wear can also prevent proper rpm adjustment. Check them for excessive wear. **See Section 17 – Torque Converter.**

CHOKE AND AIR INTAKE SYSTEM

Read **DANGER** and **WARNING** on page 14-1.

GENERAL INFORMATION

The choke system is a simple mechanism requiring very little or no maintenance. The system consists of a choke assembly that is attached to the driver side of the front body, an air filter housing with a hose that is attached to the carburetor, and an air duct that provides the engine with air from outside the engine compartment. Clean, cool air is drawn through the choke assembly and into the air cleaner intake. This feature increases engine horsepower and extends air filter life.

The choke system aids in starting the engine in cold weather. When starting a cold engine, the spring loaded choke cover is pushed in by hand. This restricts the air flow, creating a “fuel rich” mixture in the carburetor. The choke cover is held in until the engine starts, and then is released. The air flow to the engine is no longer restricted, and the engine operates normally.

The choke assembly is adjusted at the factory and does not require field adjustment. However, if the choke assembly is subjected to abuse or damaged, it may become necessary to replace the assembly.

CHOKE BUTTON REMOVAL

1. Remove the mounting screws (17) from the back side of the choke. Remove the choke assembly from the vehicle body (**Figure 14-15, Page 14-17**).

CHOKE BUTTON INSTALLATION

1. Position the choke assembly (19) on the vehicle body. Install the mounting screws (12) from inside the vehicle body and tighten to 18 in-lb (2.0 N·m) **(Figure 14-15, Page 14-17)**.
2. Check for proper operation. If the choke button does not adequately engage the choke positioner (6), loosen the #12 screw (17) and adjust the choke positioner (18) on the choke lever (6) **(Figure 14-15, Page 14-17)**. Move the positioner toward the choke button to increase choke engagement and away from the choke button to reduce choke engagement.

AIR BOX REMOVAL

1. Remove seat or lift bed to access engine compartment.
2. Remove the air intake box from the vehicle by removing intake hose (16) and three screws (24) and washers (23) that mount the intake box to the vehicle **(Figure 14-15, Page 14-17)**.

AIR BOX INSTALLATION

NOTE

- THE INTAKE DUCT MUST BE IN PLACE BEFORE THE AIR BOX CAN BE INSTALLED.

1. Check to be sure the intake seal (14) is seated correctly **(Figure 14-15, Page 14-17)**. The seal fits tightly onto the bottom side of the air box. If seal is not in place, moisture will enter the air intake system.
2. Place the air box assembly into vehicle and install three flat washers (22) and screws (23) from underside of air box mounting plate into air box **(Figure 14-15, Page 14-17)**. Tighten to 33 in-lb (3.7 N·m).
3. Place hose onto air box and secure with wire clamp. If equipped with screw clamp, tighten to 17 in-lb (1.9 N·m).
4. Test choke for proper operation.

INTAKE DUCT REMOVAL

To remove the intake duct:

1. Remove the front body. **See Section 4 – Body and Trim in the appropriate maintenance and service manual.**
2. Remove the front left wheel. **See Section 8 – Wheels and Tires in the appropriate maintenance and service manual.**
3. Remove the steering joint assembly **(Figure 14-14, Page 14-16)**.
4. Drill out the two pop rivets (26) securing the intake duct to the floorboard **(Figure 14-15, Page 14-17)**.
5. Remove three screws (23) and flat washers (22) from the bottom of the air box assembly.
6. Lift air box assembly off the intake duct. Be careful that the intake seal on the bottom of the air box assembly is not dislodged in the process.
7. Pull the intake duct forward and out of the vehicle.

INTAKE DUCT INSTALLATION

The intake duct assembly is installed from the front of the vehicle.

1. Slide the intake duct between the round crossmember and the floorboard, moving it to the rear along the underside of the floorboard. Insert the end of the intake duct through the slot in the front of the air box mounting plate.
2. Secure the front of the duct to the underside of the floorboard with two pop rivets (25) and flat washers (26) **(Figure 14-15, Page 14-17)**.
3. Install air box. **See Air Box Installation, Page 14-15.**
4. Install steering joint. **See following NOTE.**

Intake Duct Installation, Continued:**NOTE**

- MAKE SURE STEERING WHEEL AND FRONT WHEELS ARE PROPERLY ALIGNED BEFORE INSTALLING STEERING JOINT.

- 4.1. Position steering joint assembly (1) on vehicle as shown. Install three lock washers and three screws and tighten to 15 ft-lb (20.3 N·m) **(Figure 14-15, Page 14-17)**.
5. Install front left wheel. Tighten the wheel rim mounting nuts to 55 ft-lb (75 N·m).
6. Install front body.
7. Check for proper operation.

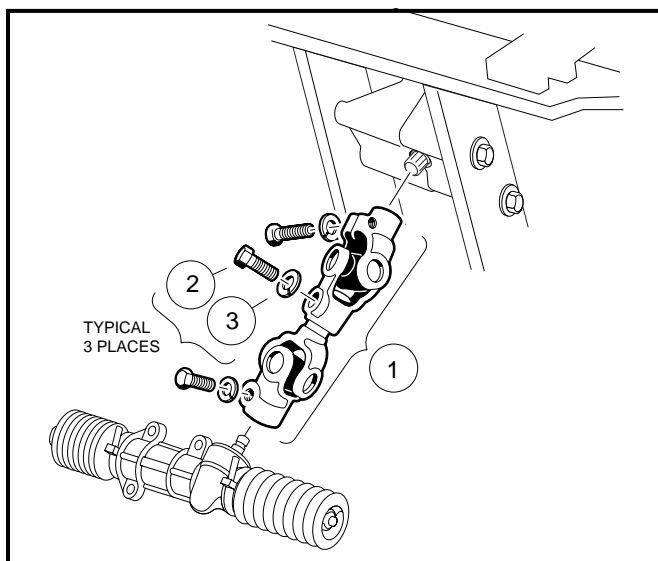


Figure 14-14 Compound Steering Joint

INTAKE DUCT REPAIR

In the event of puncture damage to the intake duct, a repair kit is available (Club Car Part No. 101971001). This kit is designed to repair small cracks or holes. If the intake duct is badly torn, it will need to be replaced.

AIR FILTER**General Information**

The air filter should be checked every year or 100 hours. More frequent service may be required in extremely dirty operating environments. Need for immediate servicing will be indicated by a loss of power, sluggish acceleration, or an engine which runs roughly with black exhaust smoke.

Air Filter Replacement

1. Remove seat or lift bed to access engine compartment.
2. Lift two latches (3) on the side of the air box **(Figure 14-15, Page 14-17)**.
3. Remove the hose clamp (15) from the air hose and remove hose from the air box assembly.
4. Standing on driver side of vehicle, grasp air hose mounting inlet and open box fully. Remove filter element (12).
5. Using a clean cloth, wipe away any dust or dirt from inside the air box. Remove all dirt build-up around the inside lip of the box or the box will not seal properly.

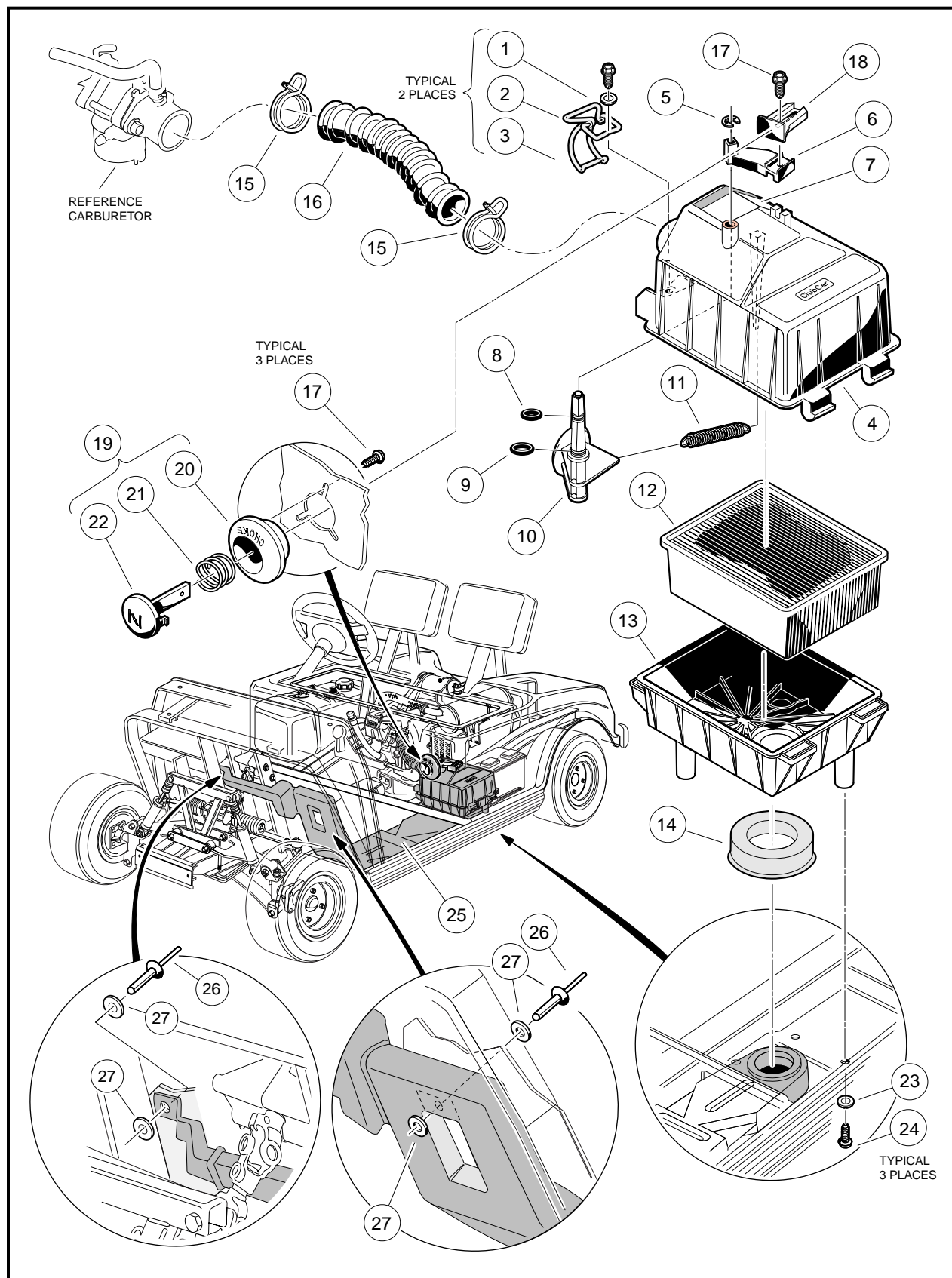


Figure 14-15 Air Intake and Choke Assemblies

Air Filter Replacement, Continued:

6. Install new air filter by inserting back edge first, and pushing down using the palm of your hand to seat filter evenly onto inside lip of air box. Ensure filter fits correctly and that the wire latches are not caught between lid and air box. Close the lid.
7. Fasten wire latches (3). Make sure latches securely engage the bottom half of the box. **See following CAUTION.**

⚠ CAUTION

- ENGINE DAMAGE WILL OCCUR IF THE AIR BOX COVER IS NOT PROPERLY SECURED.
- IF AIR BOX IS EXTREMELY DIRTY, REMOVE AIR BOX FROM VEHICLE AND CLEAN THOROUGHLY.
- USE ONLY CLUB CAR REPLACEMENT AIR FILTERS (CLUB CAR PART NO. 1015426). THE USE OF OTHER AIR FILTERS COULD RESULT IN ENGINE DAMAGE. IF THE AIR FILTER IS TOO THIN, THE COVER WILL SEAT BEFORE THE FILTER CAN SEAL, LEAVING SPACE FOR DIRT TO PASS INTO THE ENGINE ON ALL SIDES OF THE ELEMENT. THIS WILL DAMAGE THE ENGINE AND VOID THE WARRANTY.

8. Reinstall hose (16) and hose clamp (15). If equipped with screw clamp, tighten to 17 in-lb (1.9 N-m). Make sure clamp ends are located in the 12:00 o'clock position.

FUEL FILTERS

Read **DANGER** and **WARNING** on page 14-1.

GENERAL INFORMATION

Fuel is supplied to the fuel pump and carburetor through flexible lines. Two in-line filters are installed between the fuel tank and the carburetor. Fuel filters, fuel lines and the fuel tank vent should be inspected periodically for leaks.

The fuel filters should be replaced when necessary, but under no circumstances should the period of time between filter changes exceed two years or 200 hours.

FUEL FILTER REMOVAL

1. Remove seat or lift bed to access engine compartment.
2. To prevent gasoline drainage, turn the fuel shut-off valve (15) on the gas tank (19) (**Figure 14-16, Page 14-19**) to the closed (OFF) position (**Figure 14-21, Page 14-26**).
3. Remove the primary fuel filter (17) (**Figure 14-16, Page 14-19**).
 - 3.1. Remove the clamps (16) and fuel lines (1 and 2) from the filter and plug the fuel lines (**Figure 14-16, Page 14-19**).
4. Remove the secondary filter (22) (**Figure 14-16, Page 14-19**):
 - 4.1. Remove the clamps (16) and fuel lines (3 and 4) from the filter and plug the fuel lines (3 and 4) (**Figure 14-16, Page 14-19**).

FUEL FILTER INSTALLATION**⚠ CAUTION**

- FUEL FILTERS ARE MARKED WITH FLOW DIRECTION ARROWS. MAKE SURE THAT FILTERS ARE INSTALLED WITH ARROWS POINTING IN THE DIRECTION OF FUEL FLOW FROM TANK TO CARBURETOR.

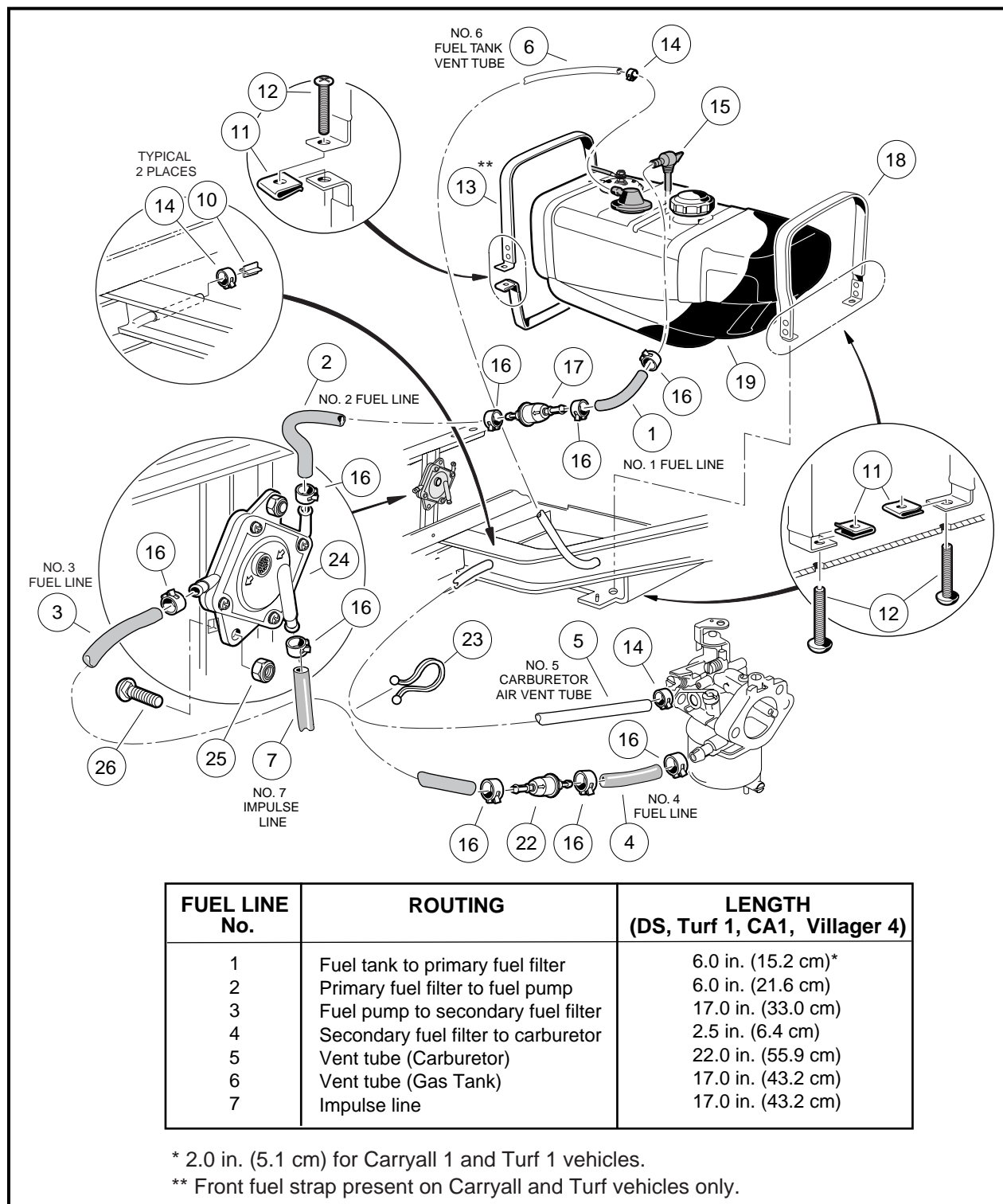


Figure 14-16 Fuel and Vent Lines

1. Install the primary fuel filter (17) in the fuel line. Use new clamps (16) (Figure 14-16, Page 14-19).
2. Install the secondary fuel filter (22) in the fuel line. Use new clamps (16).
3. Turn the fuel shut-off valve to the ON position (Figure 14-22, Page 14-26).
4. Connect the battery cables, positive (+) cable first, and tighten terminals to 20 ft-lb (27.1 N·m).

Fuel Filter Installation, Continued:

5. Place the Forward/Reverse handle in the NEUTRAL position and place the neutral lockout cam in the SERVICE position. Start the engine and check for fuel leaks. **See following WARNING.**

⚠ DANGER

- **REPAIR ANY FUEL LEAKS BEFORE OPERATING THE VEHICLE.**

6. Place the neutral lockout cam in the OPERATE position.

FUEL PUMP

Read DANGER and WARNING on page 14-1.

GENERAL INFORMATION

The gasoline vehicle is equipped with an impulse fuel pump. If the fuel pump is not operating properly, perform the following tests:

- Make sure all hose clamps are tight.
- Inspect the impulse line and fuel lines for damage or clogging.
- Make sure the air vent on the fuel pump is not clogged with dirt.
- Make sure fuel filters are not clogged.

To clean the air vent, the fuel pump must be disassembled.

FUEL PUMP REMOVAL

1. Turn the fuel shut-off valve on top of the gas tank to the closed (OFF) position (**Figure 14-21, Page 14-26**).
2. Remove hardware attaching the fuel pump (24) and lift the fuel pump out of the engine compartment (**Figure 14-16, Page 14-19**).
3. Remove the clamp and impulse line (7) from fuel pump.
4. Disconnect the fuel lines (2 and 3) from the pump and plug them to prevent gasoline leakage. **See following WARNING.**

⚠ WARNING

- CAREFULLY DRAIN ANY FUEL REMAINING IN THE PUMP INTO A CONTAINER. ADD DRAINED FUEL BACK INTO GAS TANK OR DISPOSE OF PROPERLY.

FUEL PUMP DISASSEMBLY**NOTE**

- A FUEL PUMP REBUILD KIT IS AVAILABLE FROM CLUB CAR (CLUB CAR PART NO. 1014524). THIS KIT INCLUDES ALL GASKETS, DIAPHRAGMS, AND VALVES.

1. Remove four screws (24) and lock washers (25) from front of the fuel pump (**Figure 14-17, Page 14-21**).
2. Remove the front cover of the fuel pump while holding the rest of the pump intact.
3. Note the orientations of the impulse gasket (27), the diaphragm (28), and the gasket (29), then remove them from the pump (**Figure 14-17, Page 14-21**).

⚠ CAUTION

- FUEL PUMP GASKETS AND DIAPHRAGMS MUST BE REINSTALLED IN EXACTLY THE SAME POSITIONS AND ORIENTATIONS THEY WERE IN BEFORE DISASSEMBLY, OR THE PUMP COULD LEAK. IF LEAKING OCCURS, ALL NEW GASKETS AND DIAPHRAGMS MUST BE INSTALLED.

- If the impulse gasket (27) and the diaphragm (28) come off with the front cover, note their orientations and remove them (**Figure 14-17, Page 14-21**).
- Remove the pumping chamber (30).
- Remove the back cover (36), the fuel diaphragm (34), and gasket (35) (**Figure 14-17, Page 14-21**).

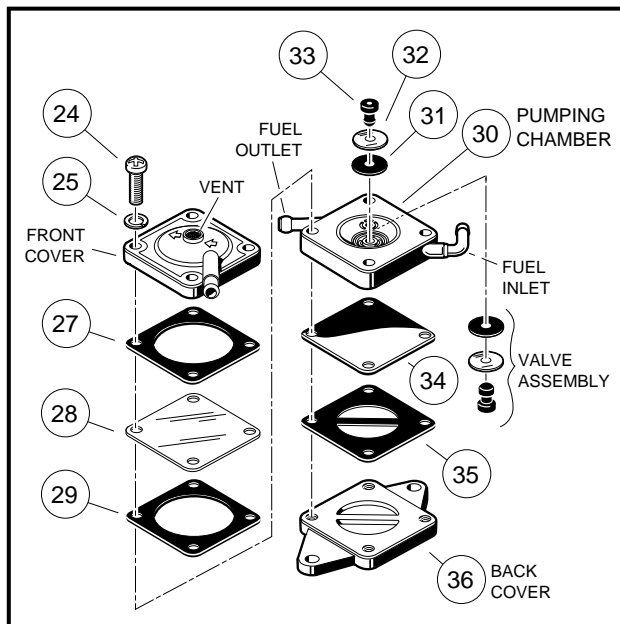


Figure 14-17 Fuel Pump

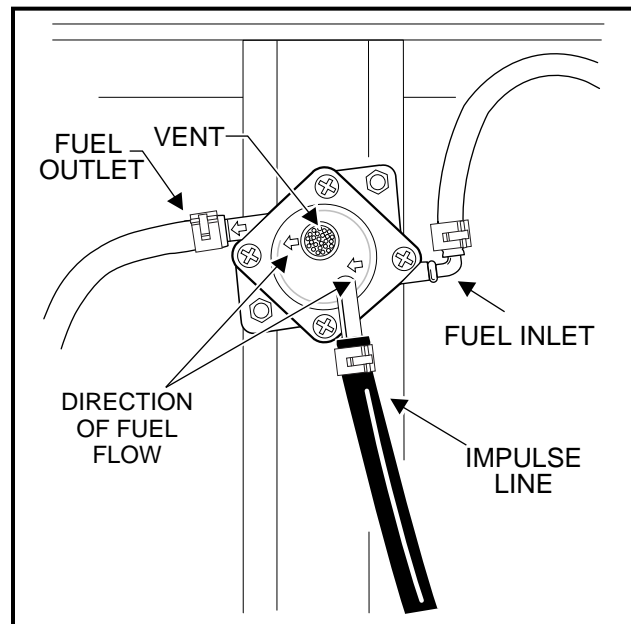


Figure 14-18 Fuel Pump Orientation

FUEL PUMP CLEANING AND INSPECTION

- Using a nonflammable solvent, clean the front cover, pumping chamber, and back cover. Be sure the vent on the front cover is clean both inside and out (**Figure 14-17, Page 14-21**).
- Inspect the valve assemblies (31, 32, and 33) and all gaskets and diaphragms for damage.
- If a valve assembly is damaged, the rubber retaining plug (33) and valve assembly must be replaced.

FUEL PUMP ASSEMBLY

- Install the fuel gasket (35) and diaphragm (34) on the back cover (36) (**Figure 14-17, Page 14-21**).
- Install the valve assembly in the pumping chamber (30). (**Figure 14-17, Page 14-21**)

⚠ CAUTION

- IF THE VALVE ASSEMBLY IS NOT INSTALLED EXACTLY AS SHOWN (**FIGURE 14-17, PAGE 14-21**), THE IMPULSE FUEL PUMP WILL NOT OPERATE PROPERLY.

- Install the pumping chamber (30) on top of the fuel diaphragm (34). Be sure the fuel inlet and the fuel outlet align with the arrows on the front of the front cover (**Figure 14-17, Page 14-21**).

Fuel Pump Assembly, Continued:

4. Install the gasket (29), clear impulse diaphragm (28), and the paper impulse gasket (27) to the pumping chamber (30).
5. Install the front cover and then the lock washers (25) and four screws (24) on the assembly (**Figure 14-17, Page 14-21**). Be sure the arrows on the front cover point from the fuel inlet to the fuel outlet (**Figure 14-18, Page 14-21**). Tighten the screws to 26 in-lb (3.0 N·m).

FUEL PUMP INSTALLATION**NOTE**

- BE SURE TO CONNECT THE FUEL LINE (2), THAT COMES FROM THE PRIMARY FUEL FILTER (17), TO THE INLET NIPPLE ON THE PUMP (**FIGURE 14-16, PAGE 14-19**). DIRECTION OF FUEL FLOW IS INDICATED BY THE ARROWS ON THE FUEL PUMP (**FIGURE 14-18, PAGE 14-21**).

1. Connect to the fuel pump the fuel line (2) that comes from the primary fuel filter (17). Install a new clamp (16) (**Figure 14-16, Page 14-19**). See **Page 14-19** for proper routing of fuel lines.
2. Connect to the output side of the fuel pump, the fuel line (3) that goes to the carburetor (**Figure 14-16, Page 14-19**).
3. Connect the impulse line (7) to the bottom nipple on the fuel pump. Use a new clamp.
4. Install the fuel pump:
 - For DS or Villager 4 vehicles, install the fuel pump on the frame and tighten the mounting bolts (26) and locknuts (25) to 60 in-lb (6.8 N·m) (**Figure 14-16, Page 14-19**).
 - For Carryall vehicles, install the fuel pump onto the mounting bracket with two thread-rolling screws and tighten to 40 in-lb (4.5 N·m).
5. Turn the fuel shut-off valve on top of the gas tank to the open (ON) position (**Figure 14-22, Page 14-26**).
6. Place the Forward/Reverse handle in the NEUTRAL position and place the neutral lockout cam in the SERVICE position and chock the wheels. Start the engine and check for fuel leaks. If the fuel pump leaks, a rebuild kit must be installed to replace all gaskets and diaphragms. See following **WARNING**.

⚠ DANGER

- REPAIR ANY FUEL LEAKS BEFORE OPERATING THE VEHICLE.

7. Place the neutral lockout cam in the OPERATE position.

FUEL TANK

Read **DANGER** and **WARNING** on page 14-1.

GENERAL INFORMATION

The gasoline vehicle is equipped with a high impact plastic, seven gallon (26.5 liter) fuel tank.

PREPARATION FOR EXTENDED STORAGE

If the vehicle is to be placed in extended storage, prepare the vehicle as follows:

1. Place the Forward/Reverse handle in the NEUTRAL position and the neutral lockout cam in the SERVICE position. Turn the fuel shut-off valve to closed (OFF) and run the engine until fuel remaining in the carburetor and fuel lines is used up and the engine stalls. Return the neutral lockout cam to the OPERATE position.

2. Loosen (do not remove) the carburetor drain screw (11) (**Figure 14-7, Page 14-7**) and drain fuel remaining in the carburetor bowl into an approved container, then pour the fuel from the container into the fuel tank.
3. Disconnect the fuel tank vent tube (6) (**Figure 14-16, Page 14-19**) from the fuel tank vent nipple.
4. Plug the fuel tank vent nipple so that it is air tight. A slip-on vinyl cap is recommended. **See following WARNING and CAUTION.**

WARNING

- IF THE FUEL TANK IS DAMAGED, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. SEE FOLLOWING TANK REMOVAL AND DISPOSAL PROCEDURE.

CAUTION

- ADD ONLY UNLEADED GASOLINE TO THE TANK. DO NOT PUT OIL INTO THE FUEL TANK.

FUEL TANK REMOVAL

1. Remove seat or lift bed to access engine compartment.
2. Remove the rear body (DS vehicle) or the seat back support (Carryall vehicle). **See Section 4 – Body and Trim in the maintenance and service manual.**
3. Place the Forward/Reverse handle in the NEUTRAL position and the neutral lockout cam in the SERVICE position.
4. Turn fuel shut-off valve to the closed (OFF) position (**Figure 14-21, Page 14-26**) and run the engine until fuel remaining in the carburetor, fuel pump, and fuel lines is used up and the engine stalls (**Figure 14-21, Page 14-26**).
5. Return the neutral lockout cam to the OPERATE position.
6. Disconnect the battery, negative (–) cable first.
7. Loosen (do not remove) the carburetor drain screw (11) (**Figure 14-7, Page 14-7**) and drain fuel remaining in the carburetor bowl into an approved container. Retighten carburetor drain screw.
8. Using a siphon with a suction device, siphon all fuel out of the tank and into an approved container. **See following DANGER and WARNING.**

DANGER

- GASOLINE – FLAMMABLE! EXPLOSIVE! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM THE VEHICLE AND SERVICE AREA.

WARNING

- NEVER ATTEMPT TO SIPHON FUEL USING A HOSE THAT DOES NOT HAVE A BUILT-IN SUCTION DEVICE.
- NEVER ATTEMPT TO SIPHON FUEL USING YOUR MOUTH.

9. If vehicle is equipped with a fuel gauge, detach the black wire and orange wire from the fuel level sending unit on the tank (**Figure 14-19, Page 14-24**). Do NOT remove the lower nut on the center stud of the sending unit.

WARNING

- MAKE SURE THE KEY SWITCH IS OFF BEFORE DETACHING WIRING.

Fuel Tank Removal, Continued:

10. Remove vent tube (6) and fuel line (1) from the fuel tank (**Figure 14-16, Page 14-19**)
11. Loosen the straps (13 and 18) by removing the screws (12) from the speed nuts (11).
12. Lift the fuel tank out of the vehicle.

FUEL TANK DISPOSAL

1. Remove the cap from the tank and thoroughly rinse it with water. The cap may be discarded or kept as a spare.
2. In a well-ventilated area, flush the fuel tank with water to remove any remaining gasoline.
3. In a well-ventilated area, set the tank upside down so that the water can drain out of it. To make sure that the tank dries completely, allow the tank to sit for 24 hours. **See following CAUTION.**

⚠ CAUTION

- DISPOSE OF WASTEWATER AND FUEL TANK IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL LAWS AND ORDINANCES.

FUEL TANK STORAGE

1. Remove the cap from the tank and thoroughly rinse it with water.
2. In a well-ventilated area, flush the fuel tank with water to remove any remaining gasoline.
3. In a well-ventilated area, set the tank upside down so that the water can drain out of it. To make sure that the tank dries completely, allow the tank to sit for 24 hours.
4. Store the tank upside down, with the cap installed, in a well-ventilated area.

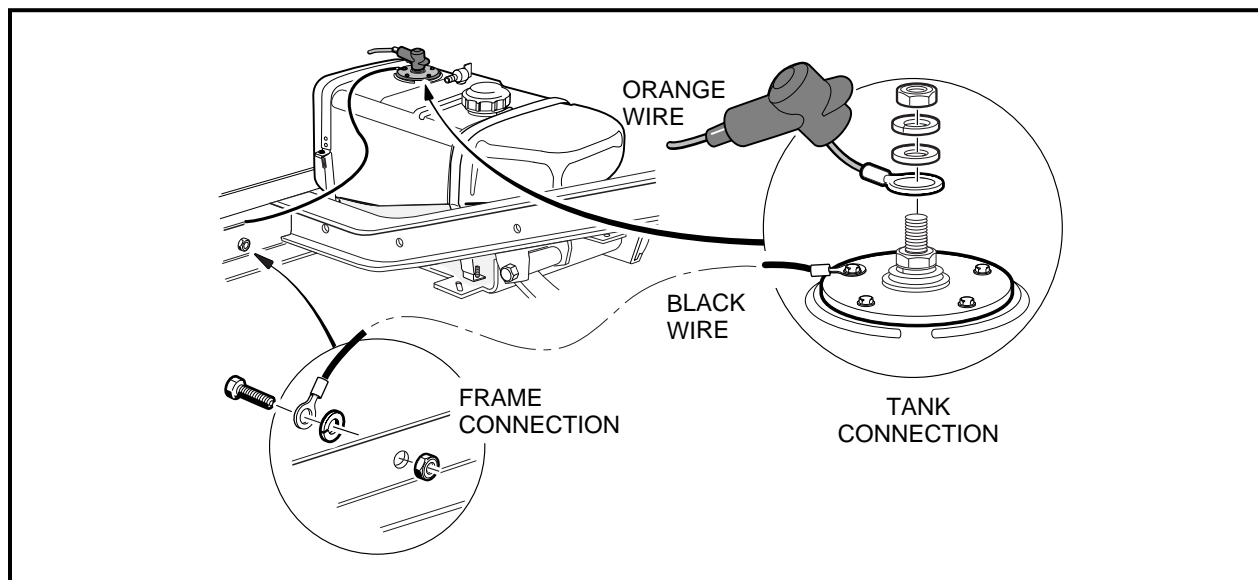


Figure 14-19 Fuel Level Sending Unit

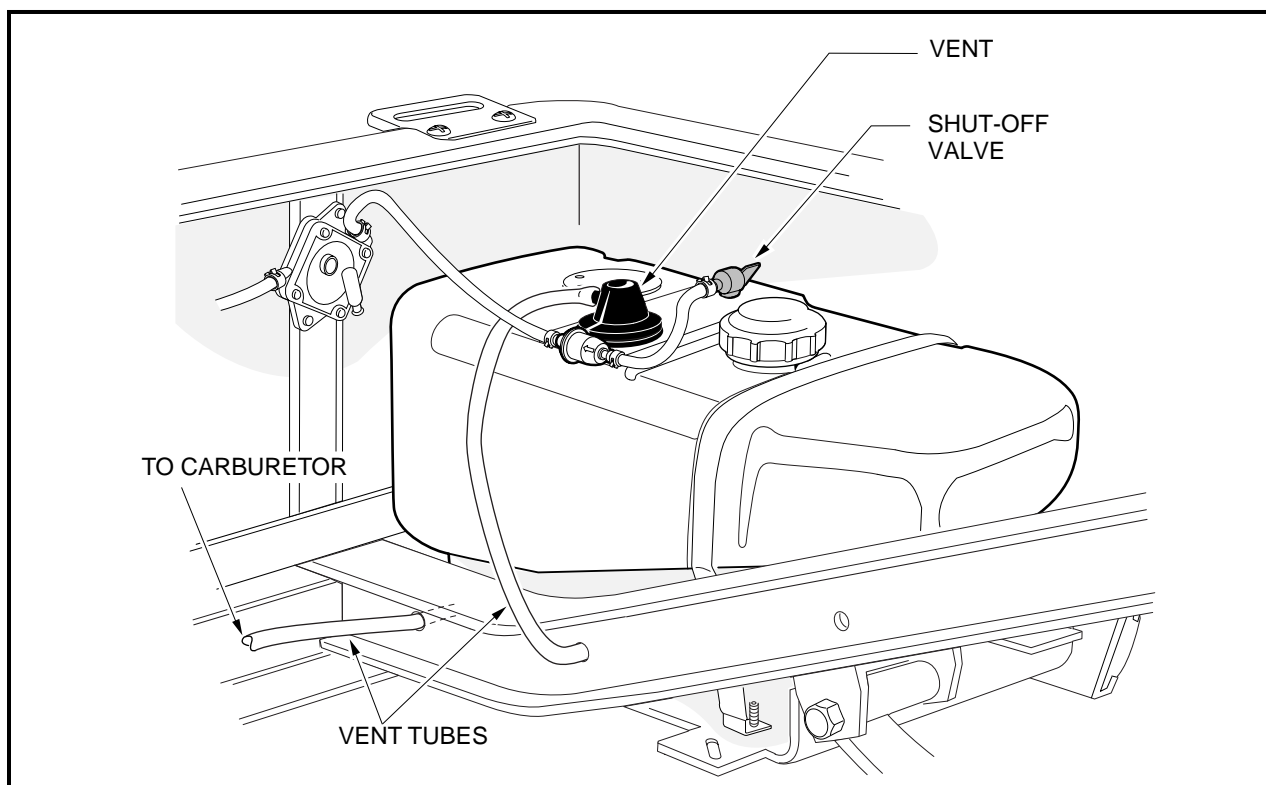
FUEL TANK INSTALLATION

1. With the retaining straps correctly positioned, install the fuel tank in the vehicle.
2. Secure the tank with the retaining straps (13 and 18) (**Figure 14-16, Page 14-19**).
 - 2.1. Position the straps in the indentions on the tank.
 - 2.2. Install the screws (12) into the speed nuts (11). Tighten screws and nuts to 25 in-lb (2.8 N-m).
3. Install the rear body on the vehicle if removed. Install seat back support if removed. **See Section 4 – Body and Trim in the maintenance and service manual.**

4. Connect the vent tube (6) to the gas tank vent (**Figure 14-16, Page 14-19**).
5. Connect the fuel line (1) to the fuel tank shut-off valve (15). Use a new clamp (**Figure 14-16, Page 14-19**).
6. Connect the black wire to one of the fuel level sending unit screws. Connect the orange wire to the center stud (**Figure 14-19, Page 14-24**) and install flat washer, lock washer, and nut. Tighten to 18 in-lb (2.0 N-m).
7. Slide the rubber boot over the stud ((**Figure 14-19, Page 14-24**).
8. Add gasoline to the tank.
9. Reconnect the battery, positive (+) cable first. Tighten the terminals to 20 ft-lb (27.1 N-m).
10. Ensure that the wheels are chocked, the Forward/Reverse handle is in the NEUTRAL position, and that the neutral lockout cam is in the SERVICE position.
11. Check to be sure the fuel shut-off valve on top of the gas tank is in the open (ON) position (**Figure 14-22, Page 14-26**).
12. Turn the key switch to the ON position and press the accelerator pedal to start the engine. **See following DANGER.**

⚠ DANGER

- **AFTER INSTALLING THE FUEL TANK AND ADDING GASOLINE, CAREFULLY CHECK ALL FUEL LINES AND CONNECTIONS FOR LEAKS. REPAIR ANY FUEL LEAKS BEFORE OPERATING THE VEHICLE.**

**Figure 14-20 Fuel Tank**

13. Allow the engine to run for a few minutes to ensure that the fuel lines are full of fuel.
14. Inspect each fuel line for leaks.
 - 14.1. Check all of the fuel line clamps at the carburetor, fuel filters, fuel pump, and fuel tank for leaks.
15. Inspect each fuel line to ensure that the lines are not cracked, cut, or worn.

FUEL LINES

Read **DANGER** and **WARNING** on page 14-1.

The fuel lines must be properly routed, and all hose clamps must be tight. The fuel lines should be kept clean. See following **WARNING**.

WARNING

- MAKE SURE FUEL LINES ARE THE RIGHT LENGTH AND ARE PROPERLY ROUTED. FAILURE TO HEED THIS WARNING COULD RESULT IN DAMAGE TO FUEL LINES AND FIRE.

Fuel line No. 1 runs directly from the fuel tank to the primary fuel filter. The primary fuel filter has an arrow indicating fuel flow direction. **(Figure 14-16, Page 14-19).**

Fuel line No. 2 runs directly from the primary fuel filter to the fuel inlet of the fuel pump.

Fuel line No. 3 runs directly from the fuel outlet of the fuel pump to the secondary fuel filter. The secondary fuel filter has an arrow indicating fuel flow direction and is identical to the primary fuel filter.

Fuel line No. 4 runs from the outlet of the secondary fuel filter to the carburetor.

Small spring steel band clamps are used on all hose connections except at the carburetor. A screw band clamp should be used at the carburetor. **(Figure 14-16, Page 14-19)**

FUEL SHUT-OFF VALVE

Read **DANGER** and **WARNING** on page 14-1.

The fuel shut-off valve is located on top of the fuel tank **(Figure 14-20, Page 14-25)**. The fuel shut-off valve should always be turned to the closed (OFF) position during vehicle storage, towing or trailering **(Figure 14-21, Page 14-26)**. Unless the engine will be run as part of a procedure, the fuel shut-off valve should also be turned OFF before performing maintenance or service procedures.

Fully Open Position

The valve's open position differs from standard valve configurations. For the valve to be fully open, it must be turned approximately 120° from the closed (OFF) position (until it cannot be turned any further) **(Figure 14-22, Page 14-26)**. If the valve becomes partially closed, the engine will not run properly due to fuel starvation.

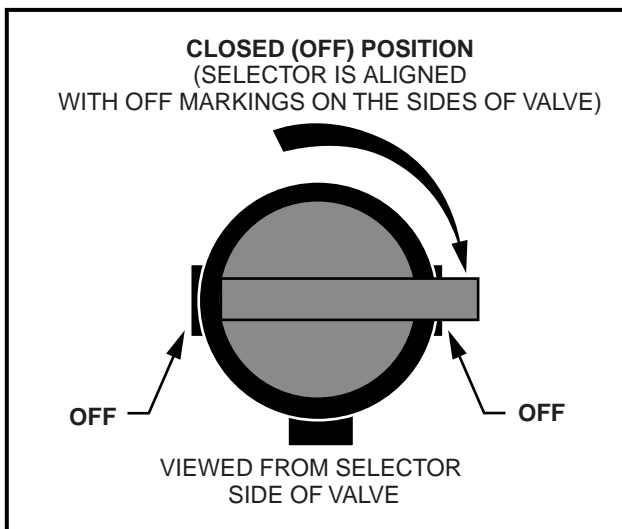


Figure 14-21 Closed Fuel Shut-off Valve

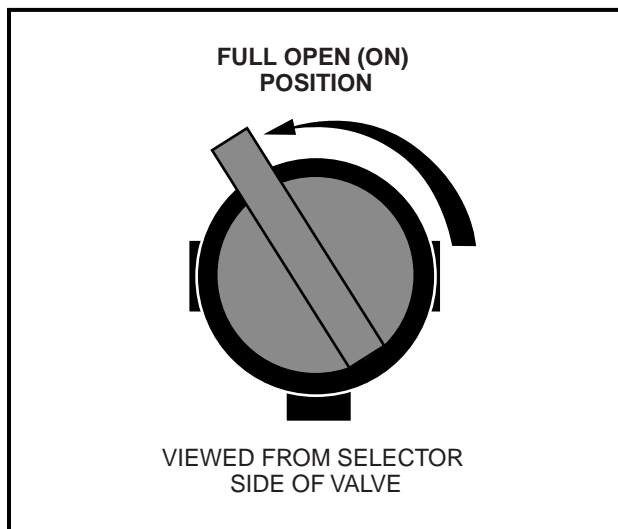


Figure 14-22 Open Fuel Shut-off Valve

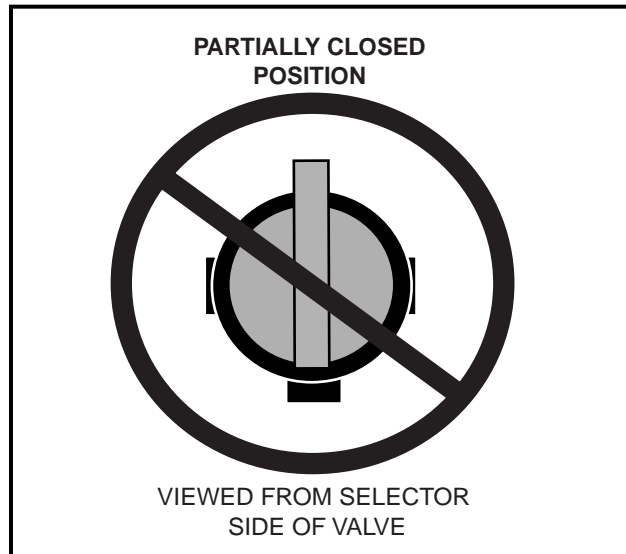


Figure 14-23 Incorrect Fuel Shut-off Valve

SECTION 15 – EXHAUST SYSTEM

DANGER

- **GASOLINE – FLAMMABLE! EXPLOSIVE! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM VEHICLE AND SERVICE AREA. SERVICE ONLY IN A WELL-VENTILATED AREA.**
- **DO NOT OPERATE GASOLINE VEHICLE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. THE ENGINE PRODUCES CARBON MONOXIDE, WHICH IS AN ODORLESS, DEADLY POISON.**

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR. FOLLOW ALL PROCEDURES EXACTLY AND HEED ALL WARNINGS STATED IN THIS MANUAL.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY PRIOR TO SERVICING.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- HOT! DO NOT ATTEMPT TO SERVICE HOT ENGINE OR EXHAUST SYSTEM. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE BURNS.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- FRAME GROUND – DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRIC WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE OR ANY OTHER METAL COMPONENT.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (–) FIRST.
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- FOR VEHICLES WITH CARGO BEDS, REMOVE ALL CARGO BEFORE RAISING THE BED. DO NOT CLOSE BED UNTIL ALL PERSONS ARE CLEAR OF CARGO BED AREA. KEEP HANDS CLEAR OF CRUSH AREA BETWEEN BED AND SEAT BACK SUPPORT. DO NOT DROP CARGO BED; LOWER GENTLY AND KEEP ENTIRE BODY CLEAR. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SEVERE PERSONAL INJURY.

GENERAL INFORMATION

The exhaust system is designed to provide quiet vehicle operation. If the muffler should ever need to be removed for repairs or replacement, follow the instructions below.

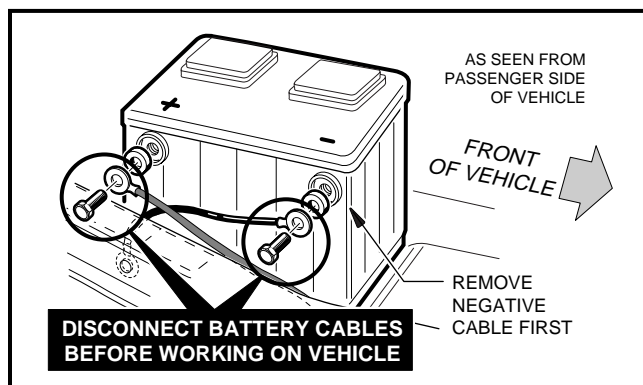


Figure 15-1 FE350 Battery

MUFFLER

MUFFLER REMOVAL

1. Disconnect the battery cables, negative (–) cable first.
2. Disconnect the spark plug wire from the spark plug.
3. Remove the hex nuts (10) and lock washers (11) (**Figure 15-2, Page 15-3**).
4. Remove the hex head cap screw (7), lock washer (8), and flat washer (9).
5. Remove the retaining bolts (5), lock washers (4), and flat washers (3) from the muffler bracket (2).
6. Remove the muffler and bracket assembly from the vehicle.
7. Remove the muffler clamp (6) from the muffler bracket (2).

MUFFLER INSTALLATION

NOTE

- ANY TIME THE MUFFLER IS REMOVED FROM THE VEHICLE, INSTALL A NEW MUFFLER CLAMP (6) (CLUB CAR PART NO. 1017689) AND MUFFLER GASKET (**FIGURE 15-2, PAGE 15-3**).

1. Use the muffler clamp (6) to attach the muffler bracket (2) to the muffler as shown (**Figure 15-2, Page 15-3**). Leave the muffler clamp loose enough to allow the muffler to move as the mounting hardware is tightened. If installing a new muffler, use the old one as a positioning guide for the clamp and bracket.
2. Place a new gasket (12) on the exhaust manifold mounting flange as shown.
3. Position the muffler and bracket assembly, and the governor cable bracket (13) and install the bolts (5), lock washers (4), and flat washers (3). Thread the bolts in only enough to support the muffler and bracket assembly. Do not tighten them.
4. Install the hex nuts (10) and lock washers (11). Tighten the nuts fingertight.
5. Install the flat washer (9), lock washer (8) and hex head cap screw (7). Tighten the cap screw fingertight.
6. Tighten the hex nuts (10) to 11 ft-lb (14.9 N·m).
7. Tighten the hex cap screw (7) to 14 ft-lb (18.9 N·m) (**Figure 15-2, Page 15-3**).
8. Tighten the muffler clamp (6) to 40 in-lb (4.5 N·m).
9. Tighten the muffler bracket mounting bolts (5) to 75 in-lb (8.5 N·m).
10. Reconnect the spark plug wire.

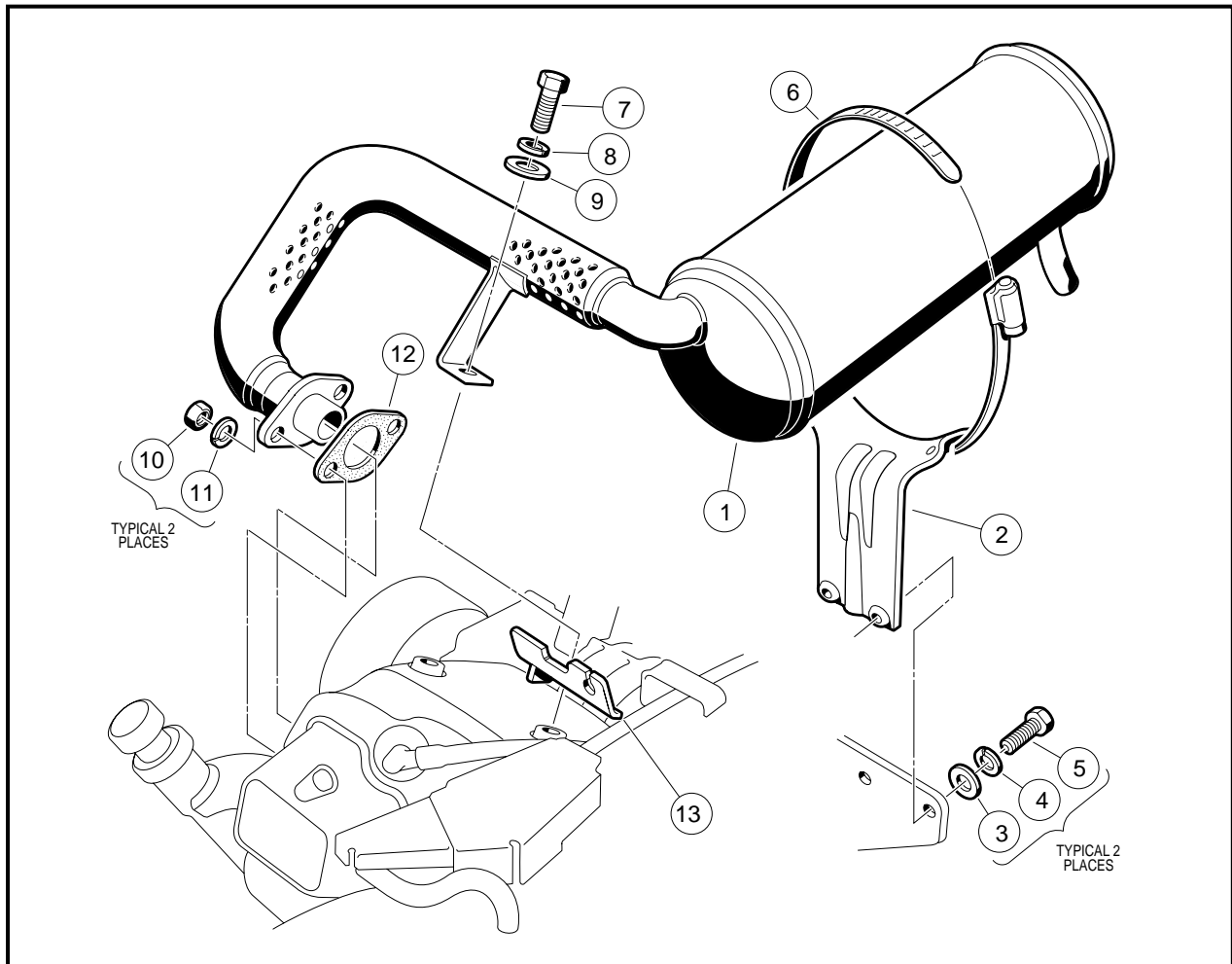


Figure 15-2 Exhaust System

11. Connect battery cables, positive (+) first and tighten terminals to 20 ft-lb (27.1 N·m) (**Figure 15-1, Page 15-2**). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305).
12. Place the Forward/Reverse handle in the NEUTRAL position and the neutral lockout cam in the SERVICE position. Start the engine and check for exhaust leaks and proper engine operation. **See following DANGER.**

⚠ DANGER

- **THE ENGINE PRODUCES CARBON MONOXIDE, WHICH IS AN ODORLESS AND DEADLY POISON. DO NOT OPERATE THE ENGINE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION.**

13. After checking the exhaust and engine for proper operation, return the neutral lockout cam to the OPERATE position.

SECTION 16 – UNITIZED TRANSAXLE

DANGER

- **GASOLINE – FLAMMABLE! EXPLOSIVE! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM VEHICLE AND SERVICE AREA. SERVICE ONLY IN A WELL-VENTILATED AREA.**
- **DO NOT OPERATE GASOLINE VEHICLE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. THE ENGINE PRODUCES CARBON MONOXIDE, WHICH IS AN ODORLESS, DEADLY POISON.**

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR. FOLLOW ALL PROCEDURES EXACTLY AND HEED ALL WARNINGS STATED IN THIS MANUAL.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY BEFORE SERVICING THE VEHICLE.
- HOT! DO NOT ATTEMPT TO SERVICE HOT ENGINE OR EXHAUST SYSTEM. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE BURNS.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- FRAME GROUND – DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRICAL WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR ANY OTHER METAL COMPONENT.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (–) FIRST.
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, SET THE PARK BRAKE WHEN LIFTING THE FRONT OF THE VEHICLE, UNLOAD THE CARGO BED, AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. USE APPROVED JACK STANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.

GENERAL INFORMATION

All gasoline-powered Club Car vehicles manufactured since the beginning of the 1997 model year are equipped with heavy-duty, fully-synchronized Unitized Transaxles. The unitized transaxle utilizes fully-synchronized internal gearing to change vehicle direction. Because the unitized transaxle is used to reverse vehicle direction, the engine, drive clutch, belt, and driven clutch rotate in the same direction; therefore, the engine and clutches are not subjected to reversing loads. This reduces maintenance requirements on the engine and clutches. With the unitized transaxle, power is transferred from the engine through the drive clutch, the drive belt, the driven clutch, and then through the unitized transaxle to the wheels.

Shifter Lever

A shifter lever, connected to a shifter arm on the unitized transaxle, is used to change the gears to one of three shift positions: FORWARD (F), NEUTRAL (N), or REVERSE (R) (**Figure 16-1, Page 16-2**). The vehicle should come to a complete stop before changing FORWARD or REVERSE direction.

Neutral Lockout

During normal vehicle operation, the neutral lockout feature prevents the engine from running when the Forward/Reverse handle is in the NEUTRAL position. If a vehicle is started in FORWARD or REVERSE and then shifted to NEUTRAL, the engine will stop running.

For the convenience of the trained technician, there is a neutral lockout cam (yellow knob) located on the back of the Forward/Reverse shifter, inside the engine compartment. If the neutral lockout cam is pulled out approximately 3/8 inch (10 mm) and then rotated one-half turn until it snaps into place, the cam will be in the SERVICE position.

When the cam is in the SERVICE position, it will allow the technician to run the engine in NEUTRAL for certain maintenance procedures. With the cam in this position, the vehicle will not operate if the Forward/Reverse handle is placed in either the FORWARD or REVERSE position.

To put the cam back into the OPERATE position, pull the cam out approximately 3/8 inch (10 mm) and rotate it one-half turn until it snaps into place. **See Neutral Lockout Circuit, Section 11, Page 11-10 .**

Governor System

The governor system is a flyweight type, and regulates vehicle ground speed. It is mounted inside the unitized transaxle and is driven by transaxle gears. Because the governor is mounted inside the transaxle, it is protected from abuse and damage common to externally mounted governor systems. If any of the governor linkages are removed in order to service other components, readjustment of the governor linkage is required. **See Governor Cable Installation and Adjustment, Section 14, Page 14-11.**

Unitized Transaxle Service

The unitized transaxle is extremely durable and should require very little service under normal operating conditions. The only service required on the unitized transaxle is to maintain proper lubricant level. **See Periodic Lubrication Schedule, Section 10.** Under normal operating conditions, adjustment to the system should not be required.

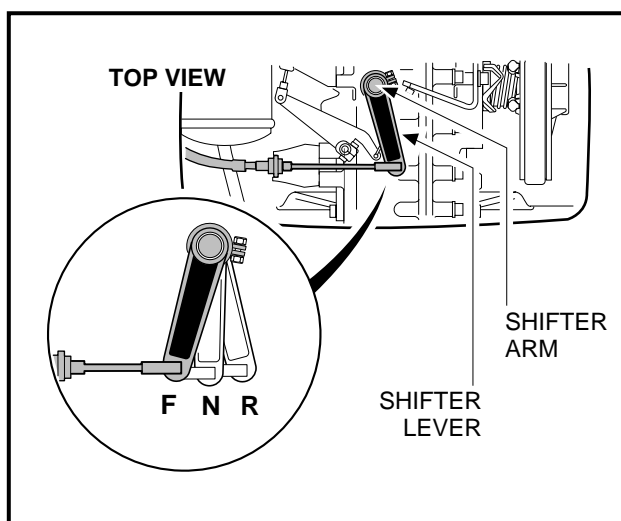


Figure 16-1 Shifter Positions

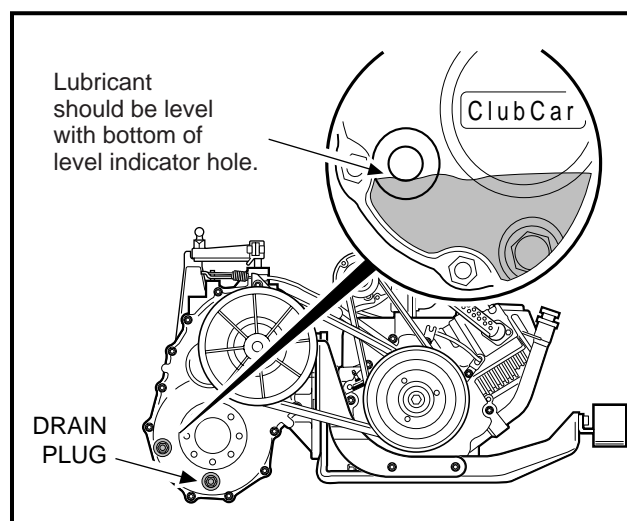


Figure 16-2 Lubricant Level

Tools Required For This Section

Hydraulic floor jack (or Chain Hoist)	12 to 18 inch Straight Edge	17 mm Socket, 3/8 inch Drive
jack stands (2) (One Ton Capacity)	Small Ball Peen Hammer (10 oz.)	7/16 inch Combination Wrench
Hydraulic Press	Plastic or Rubber Mallet	1/2 inch Combination Wrench
Bench Vise	Ratchet Wrench, 3/8 inch Drive	9/16 inch Combination Wrench
Standard Slip Joint Pliers	Torque Wrench, 3/8 inch Drive	11/16 inch Combination Wrench (2)
External Snap Ring Pliers (.070 inch Tip)	3/8 inch Socket, 3/8 inch Drive	17 mm Combination Wrench
External Snap Ring Pliers (.047 inch Tip)	7/16 inch Socket, 3/8 inch Drive	Small Flat Blade Screwdriver
90° Internal Snap Ring Pliers (.090 inch Tip)	10 mm Combination Wrench	Medium Flat Blade Screwdrivers (2)
Feeler Gauge	1/2 inch Socket, 3/8 inch Drive	No. 2 Phillips Head Screwdriver
16 inch Rolling Head Prybar	9/16 inch Socket, 3/8 inch Drive	1/4 inch Nut Driver
Small Punch or Scratch Awl	5/8 inch Socket, 3/8 inch Drive	5/16 inch Nut Driver
1/4 inch Diameter Drift or Metal Rod	12 mm Socket, 3/8 inch Drive	Small Knife or Wire Snippers
Bearing Puller Wedge Attachment (Club Car Part No. 1012812)	Axle Seal Tool (Club Car Part No. 1014162)	Governor Gear Shaft Installation Tool (Club Car Part No. 101933101)

LUBRICATION

There are two plugs located on the right (driven clutch) side of the unitized transaxle (**Figure 16-2, Page 16-2**). When the vehicle is on a level surface, the upper plug is used as a lubricant level indicator. Lubricant level should be even with the bottom of level indicator hole. The lower plug is used for draining lubricant from the transaxle. When draining lubricant, both plugs should be removed to allow the lubricant to drain faster. Be sure the drain plug and gasket are cleaned and reinstalled before filling the transaxle with new lubricant. Tighten the plug to 20 ft-lb (27.1 N-m). Use a funnel when filling the transaxle through the lubricant level indicator hole. Fill with 27 oz. (.8 liter) 80-90 WT. API Class GL or 80-90 WT. AGMA Class 5 EP gear lubricant (or until lubricant begins to run out of the level indicator hole).

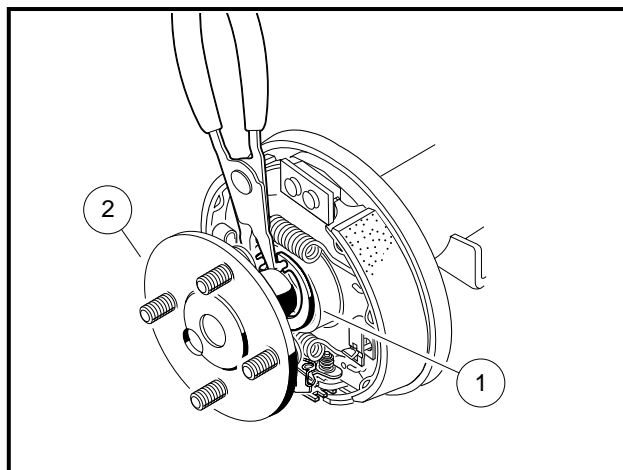


Figure 16-3 Retaining Ring

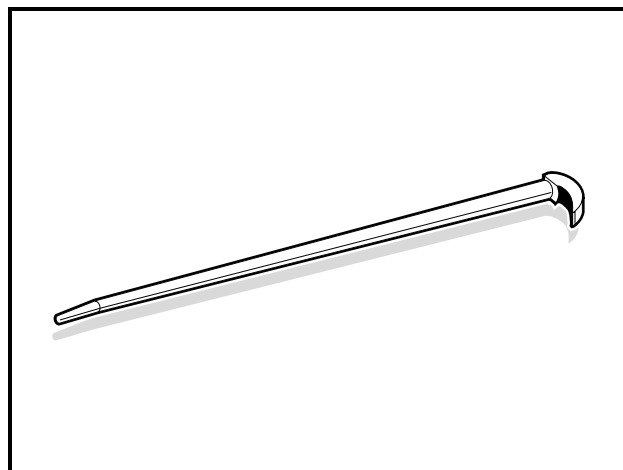


Figure 16-4 Rolling Head Prybar

AXLE SHAFT

Read DANGER and WARNING on page 16-1.

Removal of the unitized transaxle is not required for servicing or replacing axle shafts, axle bearings, or axle shaft oil seals. If the unitized transaxle is to be removed from the vehicle, then **do not** remove the wheels, axle shafts, or axle tubes first. Instructions for removing the unitized transaxle from the vehicle begin on page 16-7.

Axle Shaft, Continued:

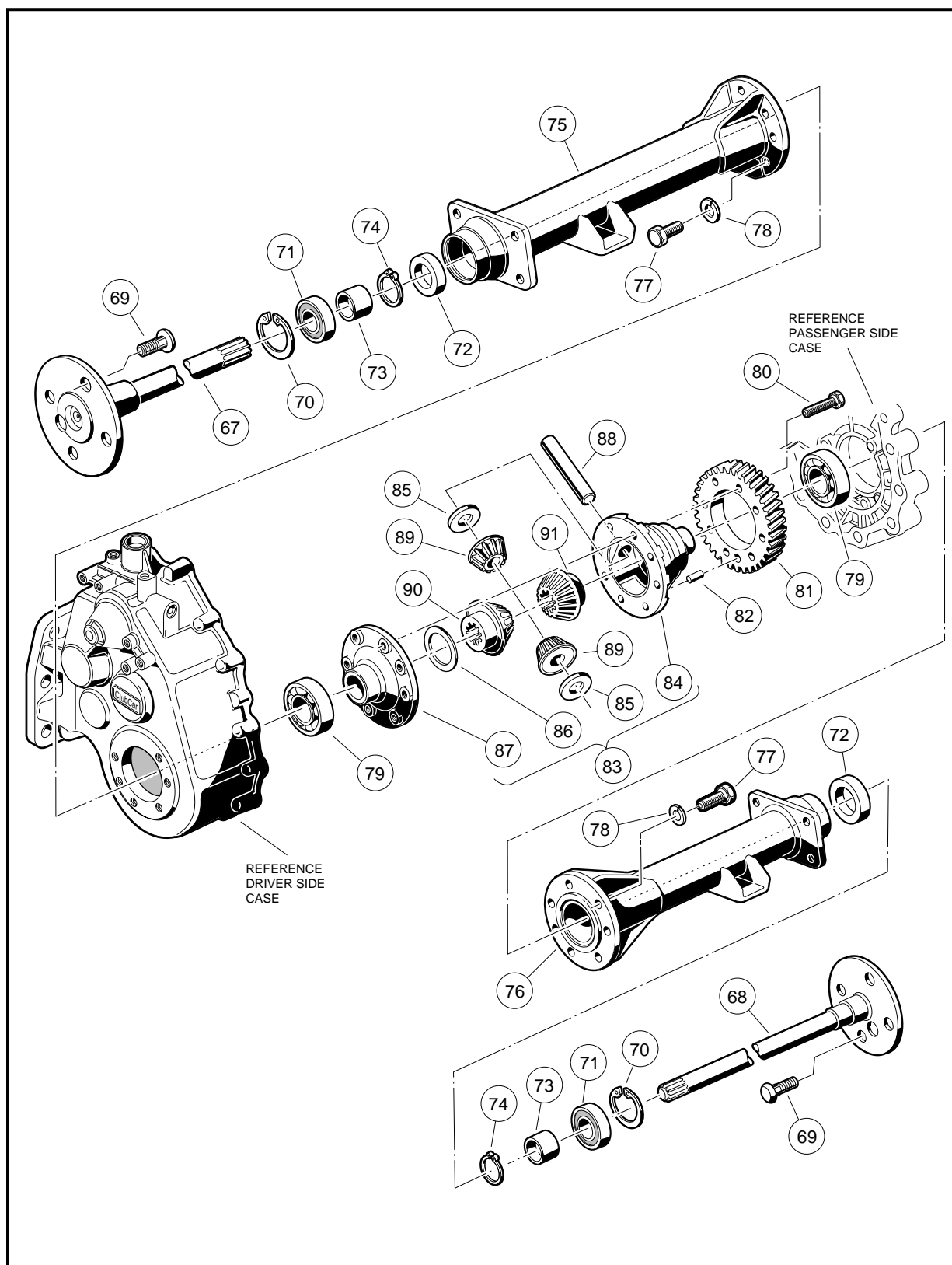


Figure 16-5 Differential Gear Case/Axle Tubes

AXLE SHAFT AND OIL SEAL REMOVAL

1. Loosen the lug nuts on the wheel to be removed.
2. Place chocks at the front wheels and lift the rear of the vehicle with a floor jack. Then place jack stands under the axle tubes to support the vehicle. **See WARNING on page 16-1.**
3. Remove the rear wheel and brake drum.
4. Using 90° internal snap ring pliers (.090 tip), remove internal retaining ring (1) from axle tube (**Figure 16-3, Page 16-3**).
5. Carefully pull the axle shaft (2) straight out of the axle tube.
6. Use a 16 inch (40 cm) rolling head prybar (**Figure 16-4, Page 16-3**) to remove the oil seal. Insert the prybar under the seal and pull oil seal out (**Figure 16-6, Page 16-5**). **See following CAUTION.**

⚠ CAUTION

- DO NOT SCAR OR DAMAGE THE INSIDE SURFACES OF THE TUBE WHEN REMOVING THE OIL SEAL. A DAMAGED TUBE MIGHT HAVE TO BE REPLACED.

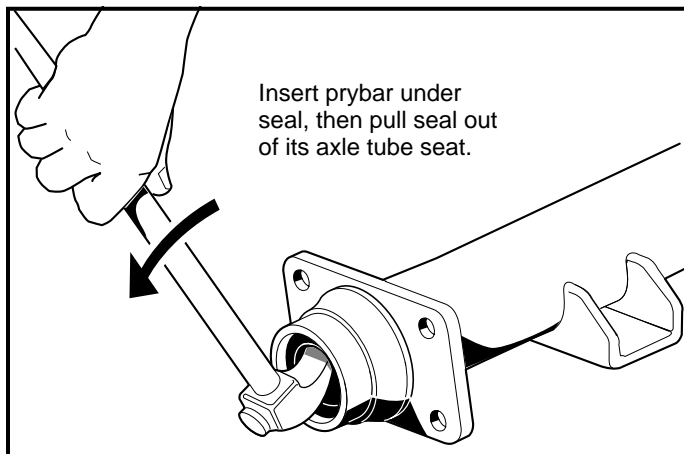


Figure 16-6 Seal Lip

7. Inspect the axle shaft assembly to be sure the bearing (71) and collar (73) have not slipped and are still seated against the shoulder on the axle shaft (**Figure 16-5, Page 16-4**).
8. Inspect the bearing. If the bearing is damaged or worn, replace it.

AXLE BEARING

Axle Bearing Removal

1. Use external retaining ring pliers (.047 tip) to remove the retaining ring (74) (**Figure 16-5, Page 16-4**), then place a bearing puller wedge attachment (Club Car Part No. 1012812) on the axle shaft between the wheel mounting flange and the bearing. **See following CAUTION.**

⚠ CAUTION

- DO NOT TIGHTEN THE BEARING PULLER WEDGE ATTACHMENT AGAINST THE AXLE SHAFT. THIS COULD DAMAGE THE AXLE SHAFT WHEN PRESSING THE BEARING AND COLLAR OFF.

2. Press the bearing (71) and collar (73) off together. Leave retaining ring (70) on the axle shaft (**Figure 16-5, Page 16-4**). **See also Figure 16-7, Page 16-6. See following NOTE.**

NOTE

- IT MAY BE NECESSARY TO HEAT THE COLLAR TO REMOVE IT.

Axle Bearing Installation

1. Install axle bearing (71) on axle (67 or 68). Push bearing onto axle until bearing is flush against axle shoulder (**Figure 16-5, Page 16-4**).
2. Apply two drops of Loctite 271® to inside of the collar. **See following CAUTION.**

⚠ CAUTION

- APPLY LOCTITE 271 TO THE INSIDE OF THE COLLAR ONLY, NOT TO THE SHAFT, SO THAT THE LOCTITE WILL BE PUSHED AWAY FROM THE BEARING AS THE COLLAR AND BEARING ARE PRESSED ON. IF LOCTITE GETS ON OR IN THE BEARING, THE BEARING MUST BE REPLACED.
- THE COLLAR SHOULD BE REMOVED NO MORE THAN TWO TIMES. IF A COLLAR IS REMOVED A THIRD TIME, THE SHAFT AND COLLAR WILL NOT FIT PROPERLY.

3. Install collar (73) (**Figure 16-5, Page 16-4**) onto axle shaft. Place axle assembly on bearing puller wedge attachment and press collar onto axle.
4. Use external snap ring pliers (.047 tip) to install retaining ring (74) (**Figure 16-5, Page 16-4**).
5. Place a **new** (sealed) bearing (71) and collar (73) on shaft (67 or 68) (**Figure 16-5, Page 16-4**).
6. Place the bearing puller wedge attachment against collar and press both bearing and collar onto shaft. Install the retaining ring (74) (**Figure 16-5, Page 16-4**). **See following CAUTION.**

⚠ CAUTION

- IF THE BEARING WAS REMOVED FROM THE SHAFT, REPLACE IT WITH A NEW ONE.
- DO NOT TIGHTEN THE BEARING PULLER WEDGE ATTACHMENT AGAINST THE AXLE SHAFT. THIS COULD DAMAGE THE AXLE SHAFT WHEN THE BEARING AND COLLAR ARE PRESSED ON.

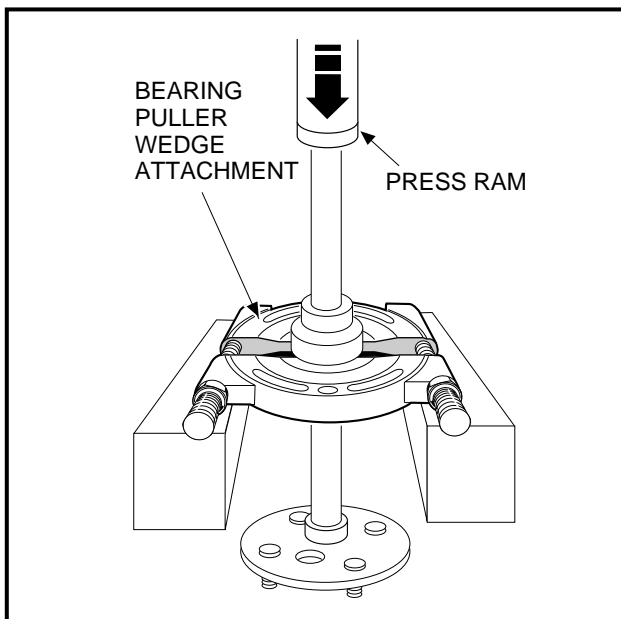


Figure 16-7 Bearing and Collar

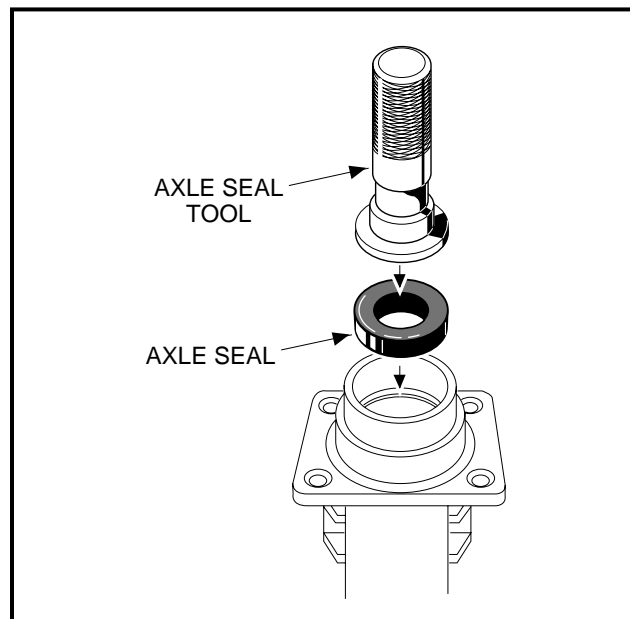


Figure 16-8 Axle Seal Tool

AXLE SHAFT INSTALLATION

1. Clean bearing and seal seats in axle tube (75 or 76) (**Figure 16-5, Page 16-4**).
2. Place a new seal (72) (**Figure 16-5, Page 16-4**) in axle tube with seal lip facing inside of the axle tube. Use an axle seal tool (Club Car Part No. 1014162) to press it in until it seats firmly in position (**Figure 16-8, Page 16-6**). See following **NOTE**.

NOTE

- THE NEW SEAL CAN BE INSTALLED BY TAPPING THE AXLE SEAL TOOL WITH A MALLET.

3. Clean the axle shaft and splines and then insert the shaft, splined end first, through the seal and into the axle tube. Be careful not to damage the seal. Then advance the shaft through the inner bearing and rotate it to align the shaft splines with the splined bore of the differential side gear. Continue advancing the shaft until the bearing seats against the axle tube shoulder.
4. Install the retaining ring (70) (**Figure 16-5, Page 16-4**) in the axle tube. See also **Figure 16-3, Page 16-3**.
5. Place a 1/4 to 3/8 inch (6-10 mm) diameter rod against the retaining ring and tap lightly at four to five locations to ensure it is properly seated. See following **WARNING**.

WARNING

- BE SURE RETAINING RING IS PROPERLY SEATED IN ITS GROOVE. IF RING IS NOT PROPERLY INSTALLED, THE AXLE ASSEMBLY WILL SEPARATE FROM THE TRANSAXLE AND DAMAGE THE AXLE ASSEMBLY AND OTHER COMPONENTS. LOSS OF VEHICLE CONTROL COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.

UNITIZED TRANSAXLE REMOVAL

Read **DANGER** and **WARNING** on page 16-1.

1. Disconnect the battery cables, negative (–) first.
2. Close the fuel shut-off valve on fuel tank. See **Section 14, Figure 14-21, Page 14-26**.
3. Detach all wires, hoses, etc. connecting the powertrain to the vehicle.
 - 3.1. Disconnect the carburetor vent tube from the carburetor (**Figure 16-9, Page 16-7**).
 - 3.2. Disconnect the air intake hose from the carburetor (**Figure 16-10, Page 16-8**).
 - 3.3. Disconnect impulse line from fuel pump (**Figure 16-11, Page 16-8**).

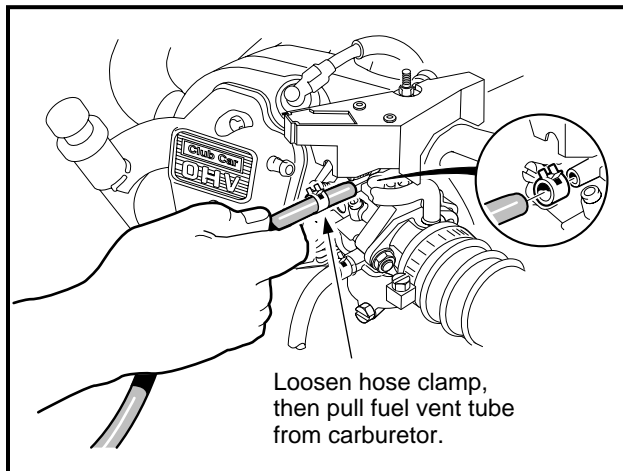
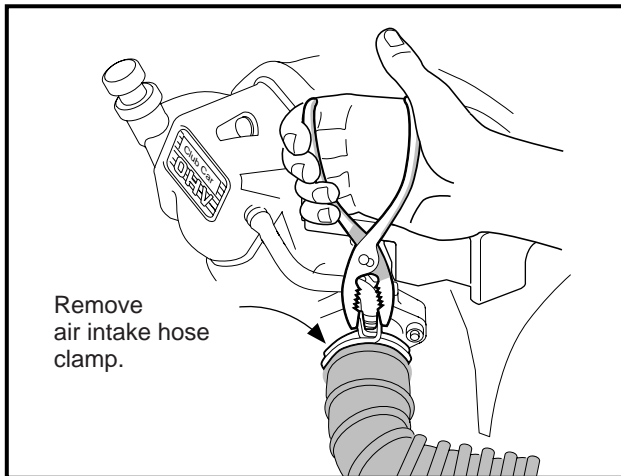
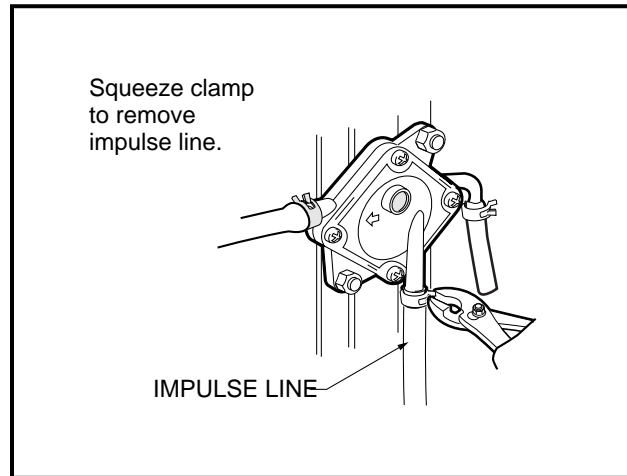
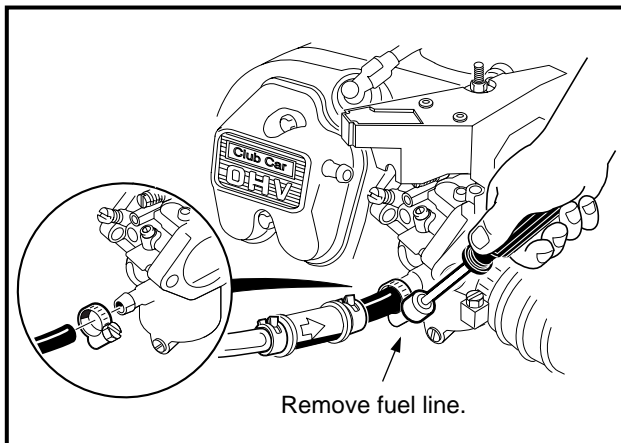
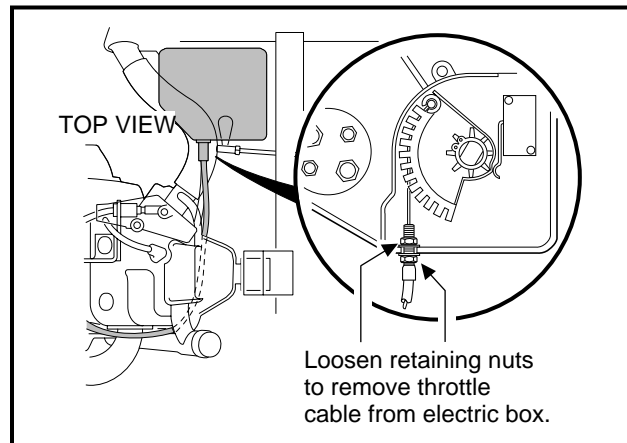


Figure 16-9 Fuel Vent Tube

Unitized Transaxle Removal, Continued:**Figure 16-10 Air Intake Hose****Figure 16-11 Impulse Line****Figure 16-12 Fuel Line****Figure 16-13 Throttle Cable**

- 3.4. Loosen the hose clamp and then disconnect the fuel line from the carburetor. To prevent spilling fuel, the disconnected end of the line can be pushed onto the impulse line fitting of the fuel pump (**Figure 16-12, Page 16-8**).
- 3.5. Remove the cover from the electrical component box. Then loosen the hardware securing the accelerator cable to the box. Disconnect the cable from the actuator cam and remove it from the box (**Figure 16-13, Page 16-8**).
- 3.6. Disconnect the engine ground wire from oil filler tube mounting bracket (**Figure 16-14, Page 16-9**).
- 3.7. Loosen nuts securing shifter cable to shifter cable mounting bracket. Then disconnect the shifter cable rod end from the shifter arm on the unitized transaxle and remove the cable from the cable mounting bracket (**Figure 16-15, Page 16-9**).
- 3.8. Mark for proper reconnection and then disconnect the 6 gauge white wire (F2 post), 6 gauge black ground wire (A2 post), and 16 gauge yellow (DF post) from starter/generator (**Figure 16-16, Page 16-9**).
- 3.9. Disconnect the oil level sensor wire (18 gauge yellow) at the connector just to the rear of the starter/generator) (**Figure 16-17, Page 16-9**).
- 3.10. Disconnect the engine kill switch wire (18 gauge white/black stripe) from the bullet connector at the lower right front of the engine (**Figure 16-18, Page 16-10**).

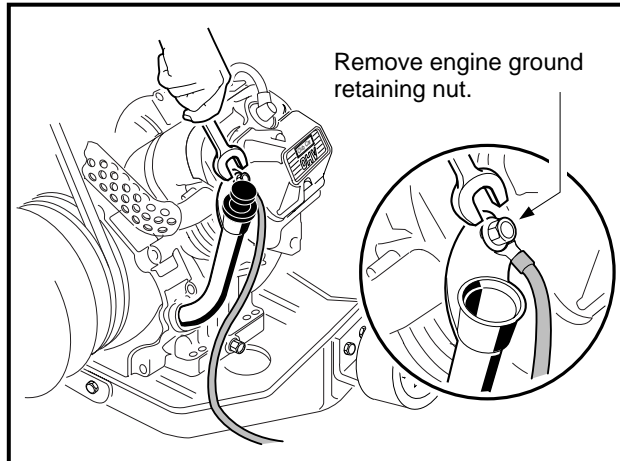


Figure 16-14 Engine Ground Wire

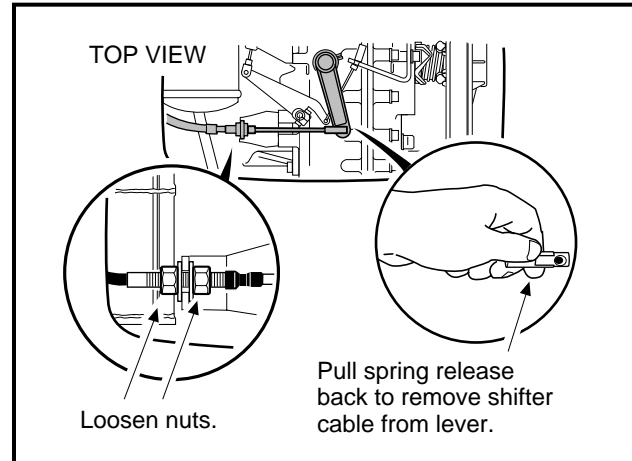


Figure 16-15 Shifter Cable

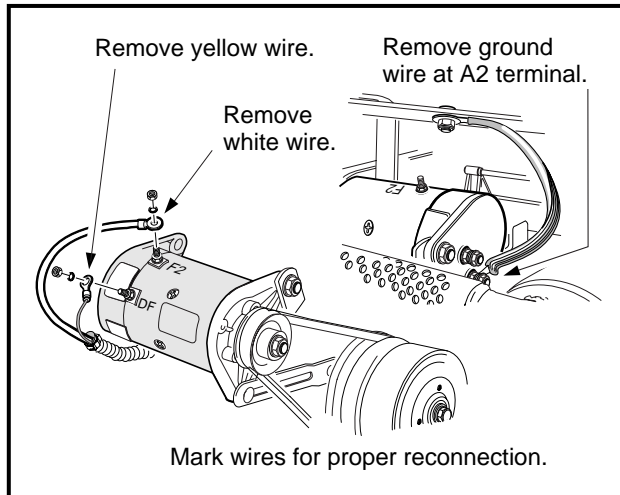


Figure 16-16 Generator Wires

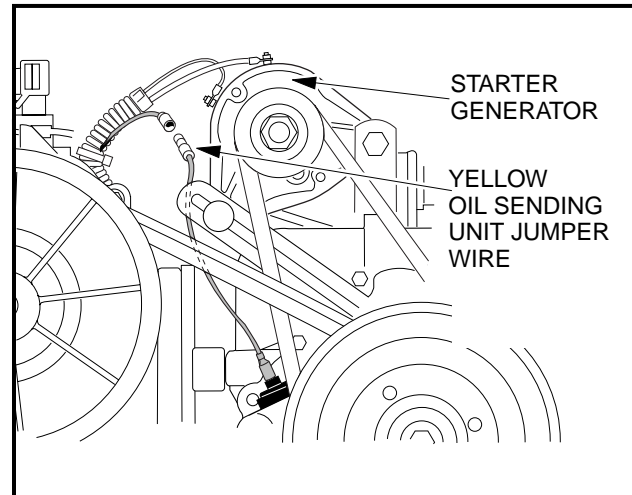


Figure 16-17 Oil Level Sensor Jumper Wire

- 3.11. Cut away the wire ties securing the engine kill switch wire at the lower right front of the engine (below the exhaust header), the wire harness at the governor cable bracket, and the wire harness to the motor mount beneath the muffler.
4. Disconnect the brake cables.
 - 4.1. Remove cotter pins (1), brake cable clevis pins (2), and E-clips (3) (**Figure 16-19, Page 16-10**).
 - 4.2. Remove the cable from the cable support bracket (**Figure 16-19, Page 16-10**).
5. Remove only the *lower* shock mounting hardware from both rear shocks (**Figure 16-20, Page 16-10**).
6. Position a floor jack under the vehicle frame crossmember or trailer hitch mount as shown (**Figure 16-21, Page 16-10**).
7. Raise vehicle just enough to relieve tension from leaf springs, then remove the bolts securing the leaf springs to the shackles (**Figure 16-22, Page 16-11**).
8. Remove the bolts securing the leaf springs to their front mounts (**Figure 16-23, Page 16-11**).
9. Continue raising vehicle until frame or trailer hitch is higher than the top of the unitized transmission (enough to allow transaxle and engine to be rolled under and out of vehicle) (**Figure 16-26, Page 16-12**).
10. Position jack stands, adjusted to support the vehicle at this height, under the frame cross-member between the leaf spring mounts and side stringers, just forward of each rear wheel. Lower the floor jack to allow the jack stands to support the vehicle (**Figure 16-27, Page 16-12**).

Unitized Transaxle Removal, Continued:

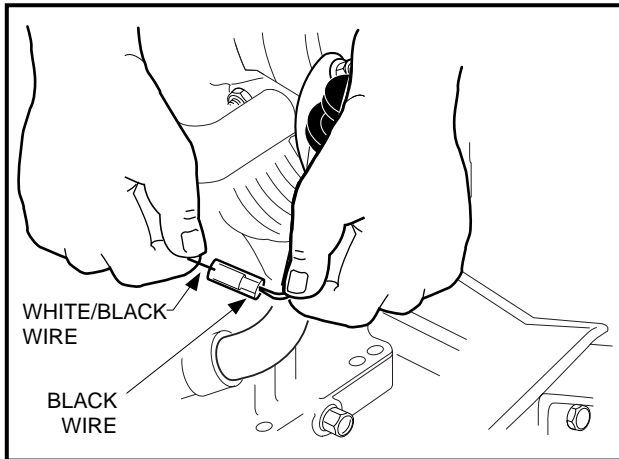


Figure 16-18 Ignition Kill Wire

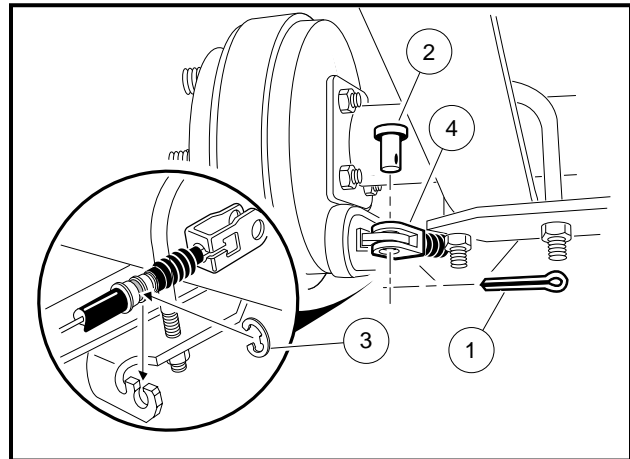


Figure 16-19 Brake Cable

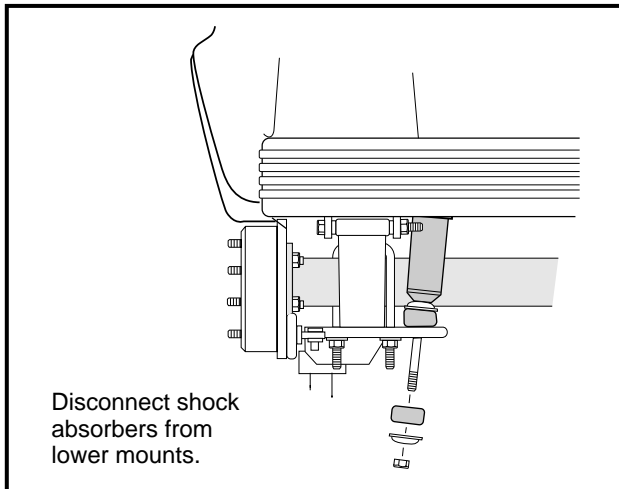


Figure 16-20 Shock Absorbers

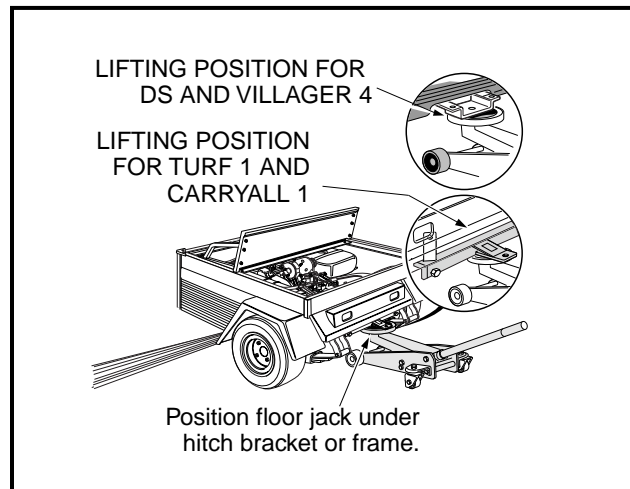


Figure 16-21 Floor Jack

11. Pull the floor jack from beneath the vehicle and move it away.
12. Lift the snubber out of the snubber bracket in the vehicle frame and lower it to the floor (**Figure 16-28, Page 16-12**). The powertrain should be completely disconnected from the vehicle and resting on the floor.
13. Grasp the ends of the leaf springs at the rear of the vehicle and roll the drivetrain out from under the vehicle (**Figure 16-29, Page 16-12**).
14. Place blocks under the engine pan so they will completely support the engine and keep it **level to the floor** (**Figure 16-24, Page 16-11**). See following **NOTE**.

NOTE

- PLACE THE BLOCKS SO THEY WILL SUPPORT THE ENGINE WHEN THE TRANSAXLE IS DETACHED AND MOVED AWAY FROM THE ENGINE.

15. Remove the drive belt.
 - 15.1. Grasp belt midway between drive and driven clutch and pull up on belt to force the driven clutch sheaves apart. Roll the belt counterclockwise while pulling it off driven clutch (**Figure 16-25, Page 16-11**).

16. Remove the driven clutch retaining bolt and remove the driven clutch from the unitized transaxle (**Figure 16-30, Page 16-13**).
17. Loosen, but do not remove, the governor arm retaining bolt. Remove the governor arm from the shaft (**Figure 16-31, Page 16-13**).
18. Remove screws securing the governor cable bracket to transaxle (**Figure 16-32, Page 16-13**).
19. Remove screws securing the accelerator cable bracket to transaxle (**Figure 16-33, Page 16-13**).
20. Remove screws (2) securing the transmission shift cable bracket (1) to transaxle (**Figure 16-35, Page 16-14**). See following NOTE.

NOTE

- THE GOVERNOR CABLE AND THE ACCELERATOR CABLE SHOULD REMAIN ATTACHED TO THE GOVERNOR ARM.

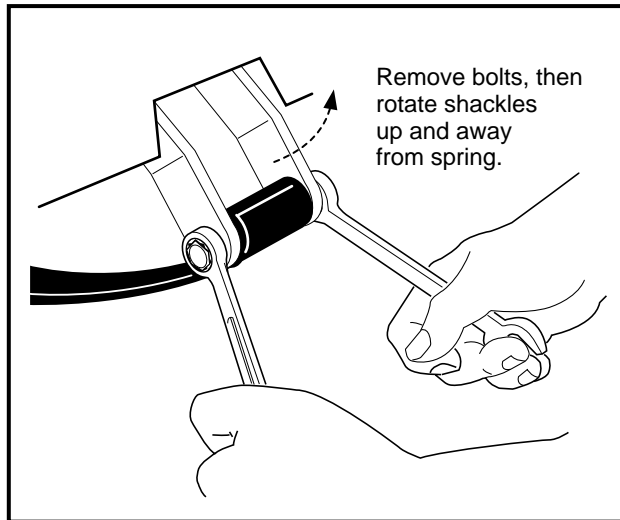


Figure 16-22 Rear Shackles

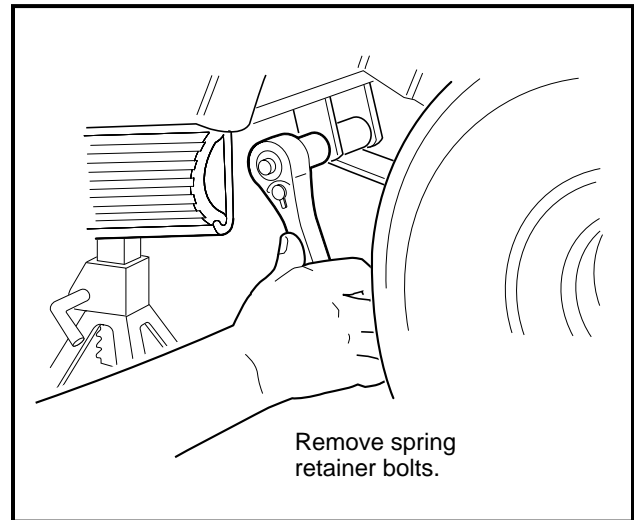


Figure 16-23 Spring Retainer Bolts

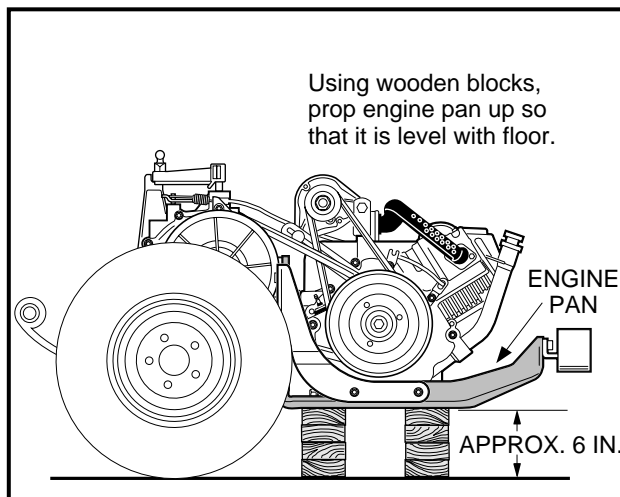


Figure 16-24 Position Powertrain

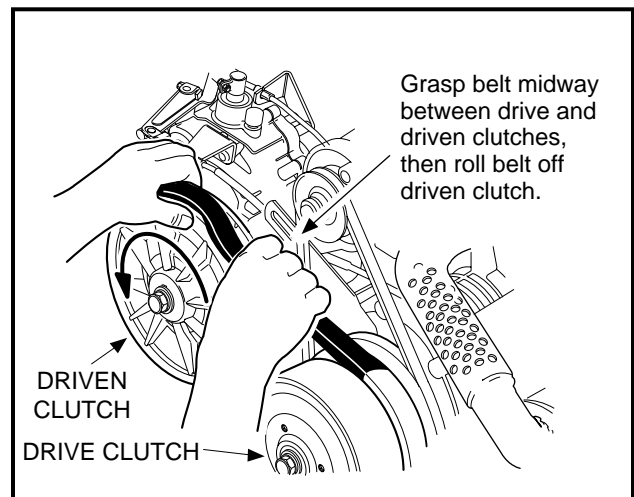


Figure 16-25 Remove Drive Belt

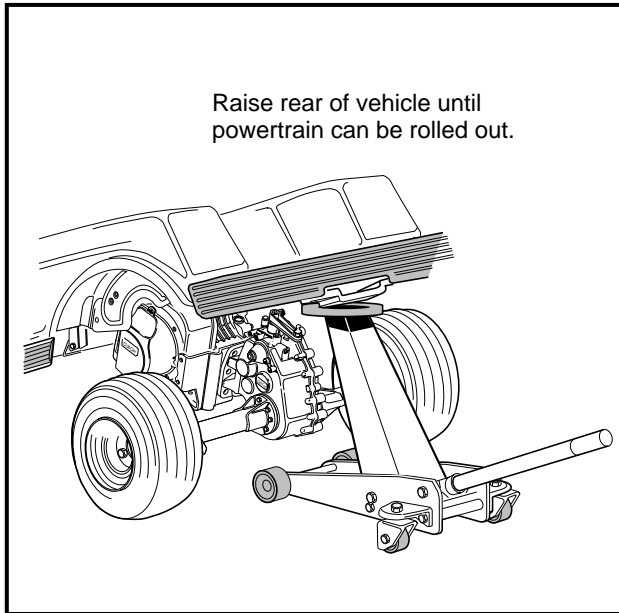


Figure 16-26 Raise Vehicle

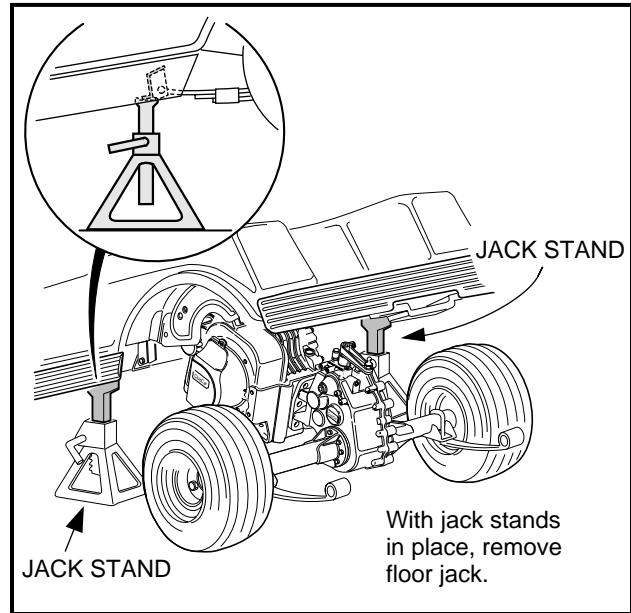


Figure 16-27 Position Jack Stands

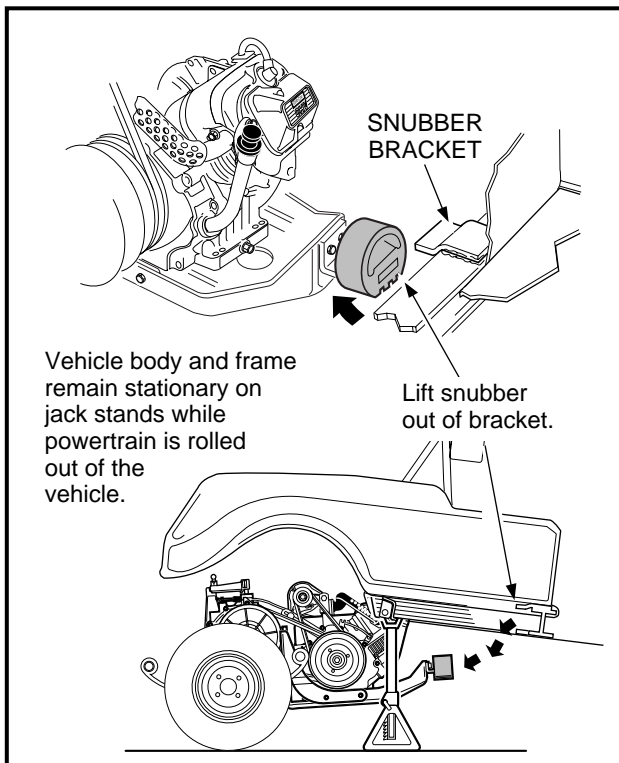


Figure 16-28 Snubber

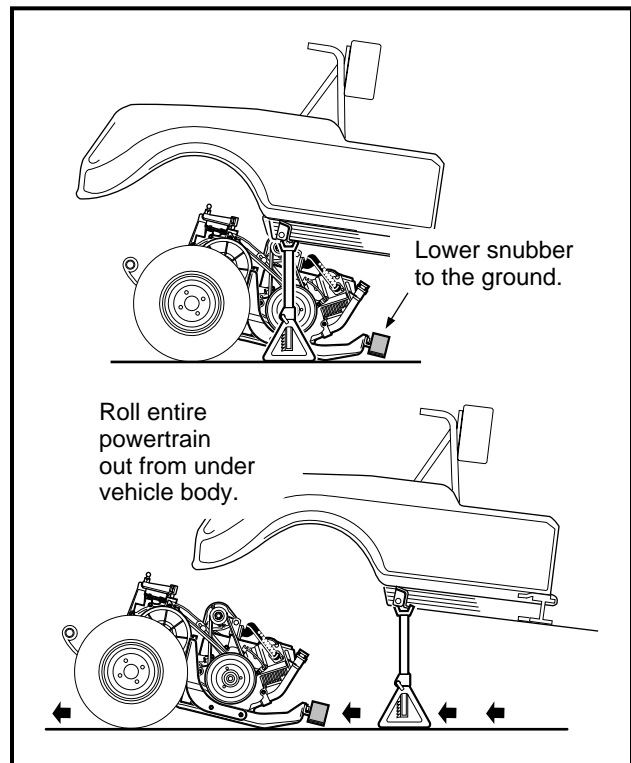


Figure 16-29 Remove Powertrain

21. Remove the six bolts mounting the unitized transaxle to the engine.
 - 21.1. Remove four transaxle mounting bolts (one at each corner of the transaxle mounting plate) as shown (**Figure 16-34, Page 16-13**).
 - 21.2. Remove two middle transaxle mounting nuts as shown (**Figure 16-34, Page 16-13**).
22. Remove the leaf springs, wheels and brake assemblies from the transaxle.

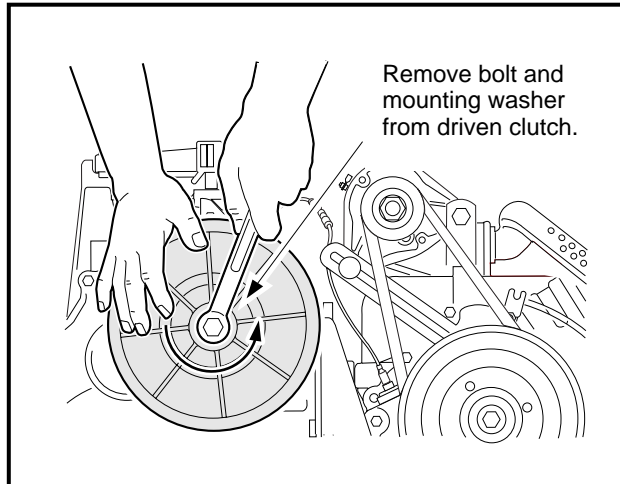


Figure 16-30 Driven Clutch

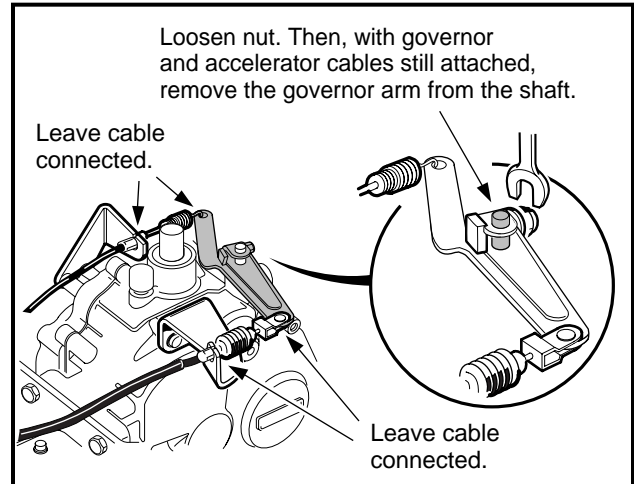


Figure 16-31 Governor Arm

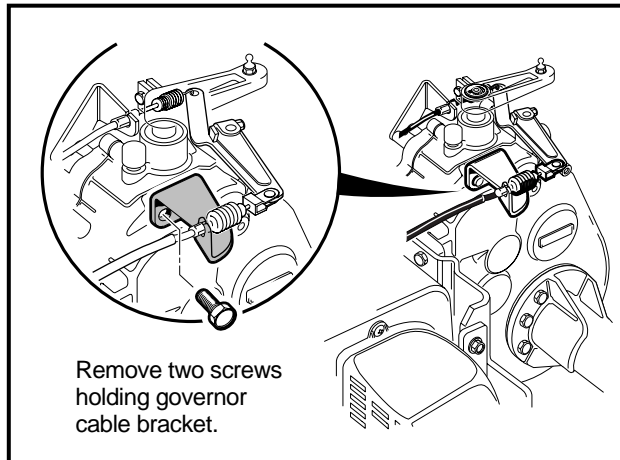


Figure 16-32 Governor Cable Bracket

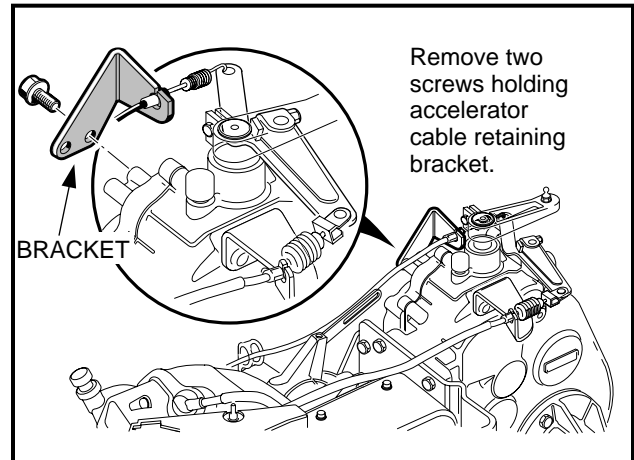


Figure 16-33 Accelerator Cable Bracket

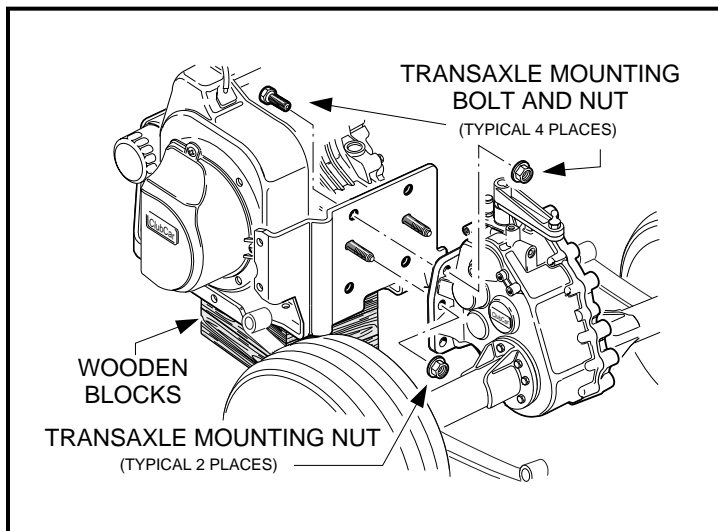


Figure 16-34 Transaxle Mounting

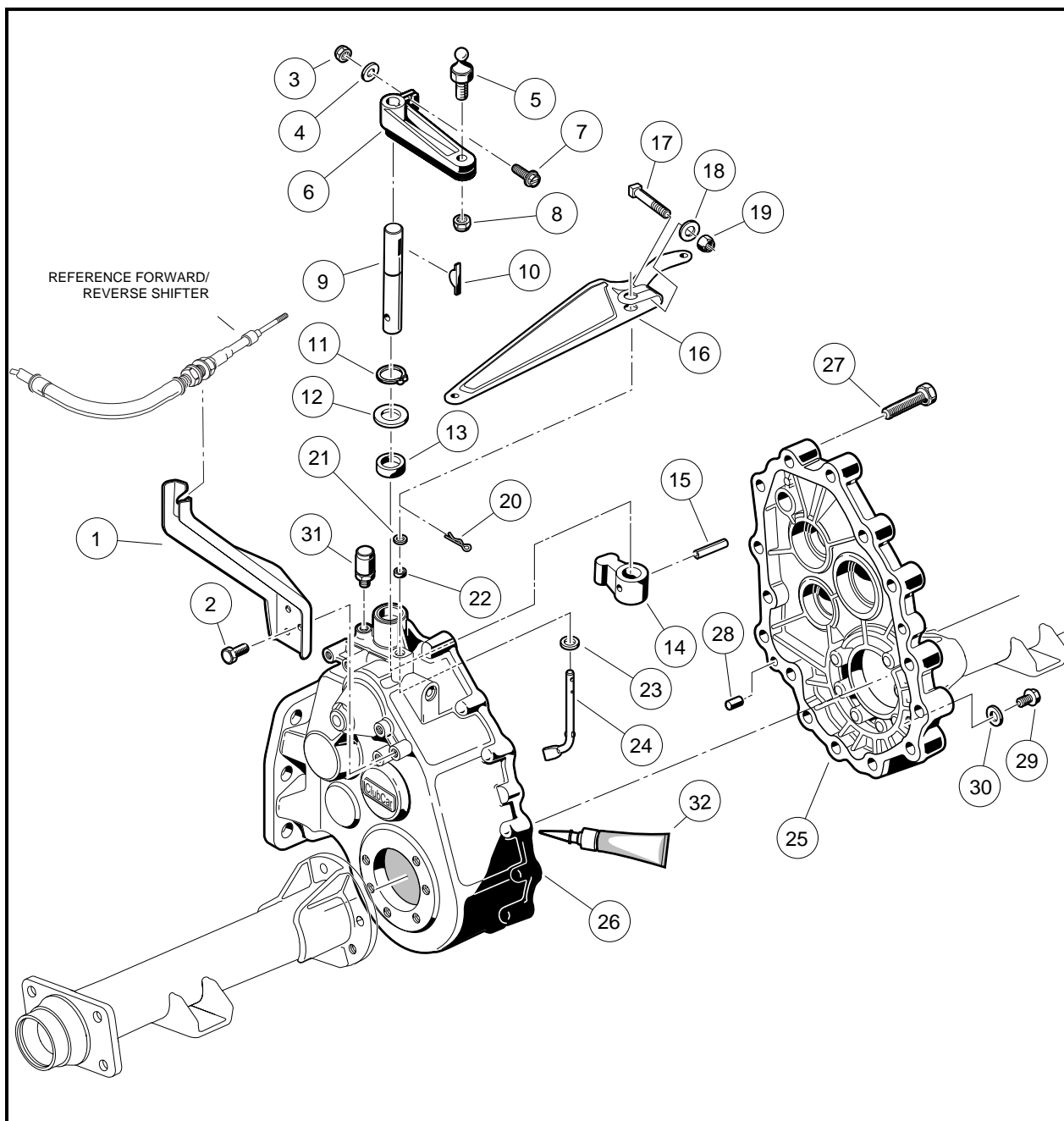


Figure 16-35 Transaxle Gear Casing and Brackets

UNITIZED TRANSAXLE DISASSEMBLY

Read **DANGER** and **WARNING** on page 16-1.

NOTE

- THE FOLLOWING INFORMATION PROVIDES INSTRUCTIONS FOR DISASSEMBLING THE UNITIZED TRANSAXLE; HOWEVER, THE TRANSAXLE CASE CAN BE SEPARATED AND GEARS ACCESSED WITHOUT REMOVING THE AXLES OR AXLE TUBES FROM THE CASE.

1. Remove the drain plug and gasket. Drain and dispose of the oil properly (**Figure 16-2, Page 16-2**).
2. Using 90° (.090 tip) internal snap ring pliers, remove the internal retaining rings (74) (**Figure 16-5, Page 16-4**) from the axle tubes. **See also Figure 16-3, Page 16-3.**
3. Pull the axles (67 and 68) out of the axle tubes (**Figure 16-5, Page 16-4**).
4. Remove seven bolts, with lock washers (77), mounting each axle tube to the transaxle case (**Figure 16-5, Page 16-4**). Then remove axle tubes from the transaxle case.

NOTE

- IT MAY BE NECESSARY TO TAP THE AXLE TUBE WITH A RUBBER OR PLASTIC Mallet TO BREAK IT FREE FROM THE TRANSAXLE CASE.

5. Remove the fifteen bolts (27) that hold the transaxle housing together (**Figure 16-35, Page 16-14**).
6. The unitized transaxle is equipped with a slot for prying the housing apart. Use the slot to open the case. Pull the housing apart, making sure all gear assemblies inside the transaxle stay together in one (either) side of the case. **See following CAUTION.**

CAUTION

- TO PREVENT DAMAGE TO THE MATING SEAL SURFACES OF THE CASE, USE CARE WHEN SEPARATING THE HALVES.

7. Turn the case section containing the gearing on edge as shown (**Figure 16-36, Page 16-15**). While holding it in this position, gently rock all the gear assemblies to slightly loosen them in their seating.

CAUTION

- TO PREVENT DAMAGE TO THE GEARS, USE EXTREME CARE WHEN HANDLING THEM.

8. When all the gear assemblies are slightly loosened, remove the differential gear case assembly by gently rocking it while pulling it from the case (**Figure 16-37, Page 16-15**).

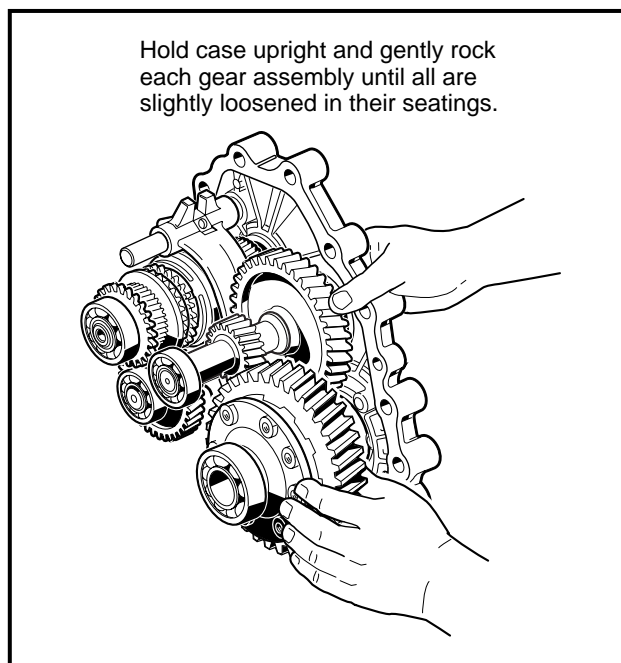


Figure 16-36 Loosen Gears

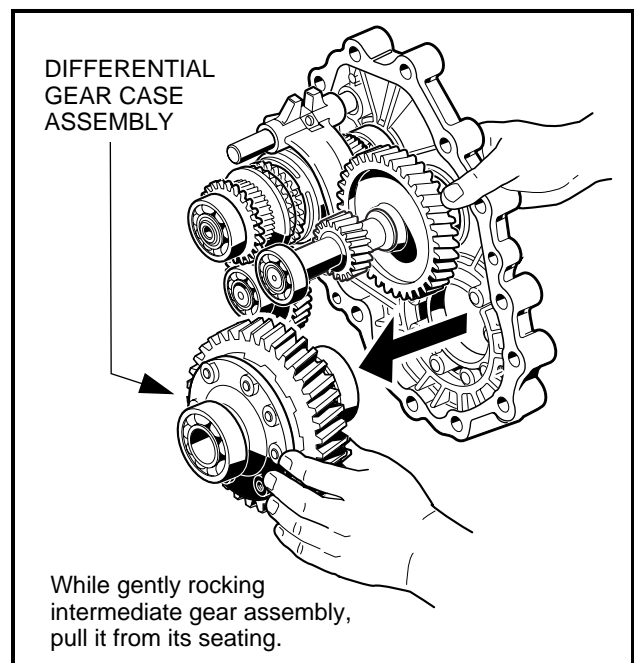
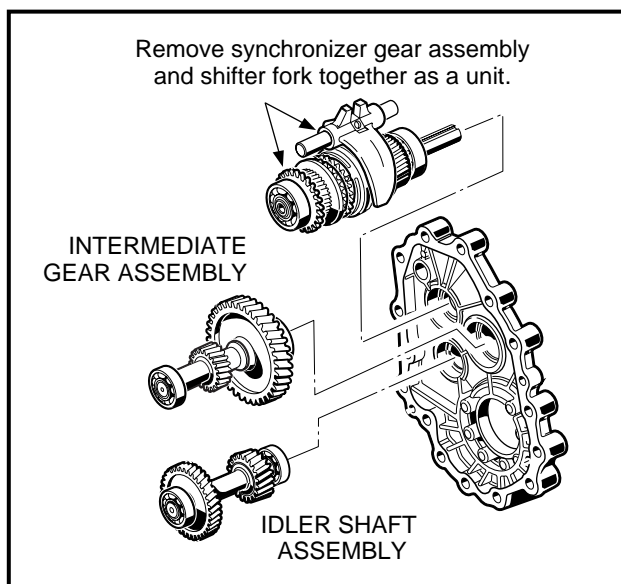
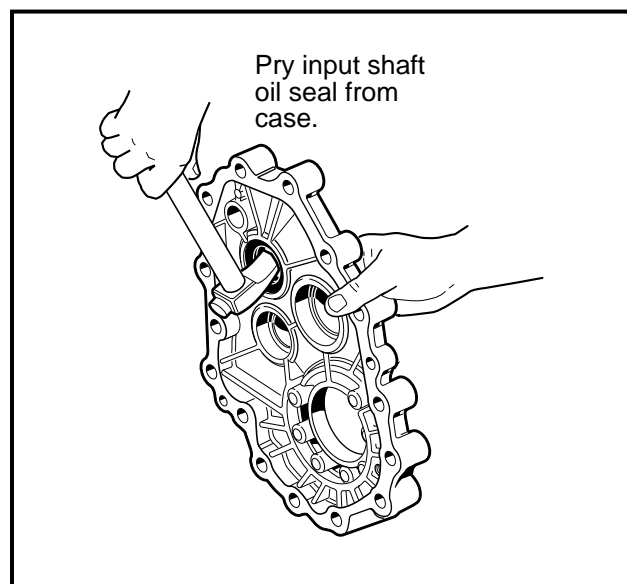


Figure 16-37 Remove Differential Gear Case

Unitized Transaxle Disassembly, Continued:

9. Continue to rock and loosen the remaining gear assemblies until the intermediate gear assembly can be removed from the case. Then remove the idler shaft assembly (**Figure 16-38, Page 16-16**).
10. Remove the synchronizer gear assembly and shifter fork assembly as a unit from the case (**Figure 16-38, Page 16-16**).
11. Use a seal puller (Club Car Part No. 1012809) or rolling head prybar to remove the input shaft oil seal from the case (**Figure 16-39, Page 16-16**).
12. Remove the oil flow guide from the case (**Figure 16-40, Page 16-17**).
13. Remove the shifter shaft and oil seal from the case (**Figure 16-40, Page 16-17**).
 - 13.1. Loosen nut (3) and bolt (7) on transmission shifter lever and remove lever from shaft (**Figure 16-35, Page 16-14**).
 - 13.2. Remove woodruff key (10) from shaft (**Figure 16-35, Page 16-14**).
 - 13.3. Use snap ring pliers (.047 tip) to remove the retaining ring (11) on the shifter shaft (**Figure 16-35, Page 16-14**).
 - 13.4. Remove flat washer (12) from the shifter shaft on the outside of the case as shown, then remove the shifter shaft by pushing it through the case toward the interior of transaxle (**Figure 16-35, Page 16-14**).
 - 13.5. Use a seal puller to remove the shifter shaft oil seal (13) from the case (**Figure 16-35, Page 16-14**).
14. Remove the breather (31) from the case (**Figure 16-35, Page 16-14**).
15. Remove the governor assembly from the case.
 - 15.1. Remove the cotter pin (20) and flat washer (21) from the pivot arm (24) (**Figure 16-35, Page 16-14**).
 - 15.2. Remove the pivot arm (24) by pulling it through the wall to the interior of the case.
 - 15.3. Use a small chisel or similar pointed instrument to pry the pivot arm oil seal (22) (**Figure 16-35, Page 16-14**) out of the case (**Figure 16-41, Page 16-17**).
 - 15.4. Remove the governor gear assembly (63 and 64) and flat washer (62) (**Figure 16-42, Page 16-18**) by lightly tapping the gear shaft through the case wall, from the outside, with a hammer and drift. **See also Figure 16-43, Page 16-19.**

**Figure 16-38 Remove Intermediate Gear****Figure 16-39 Input Shaft Oil Seal**

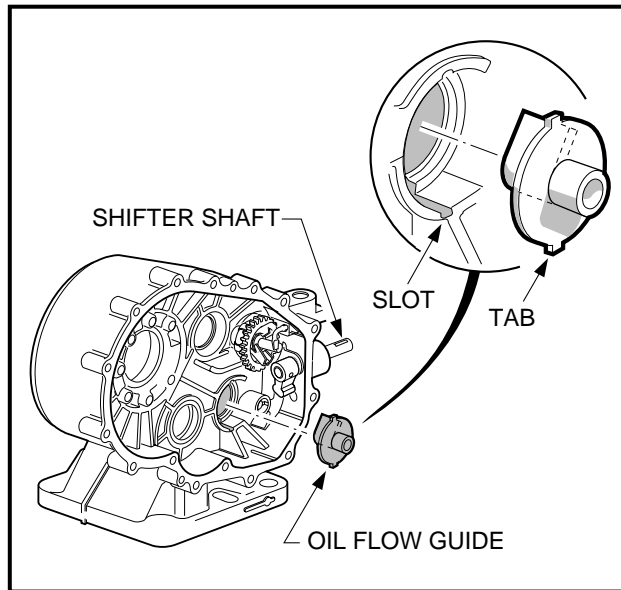


Figure 16-40 Oil Flow Guide

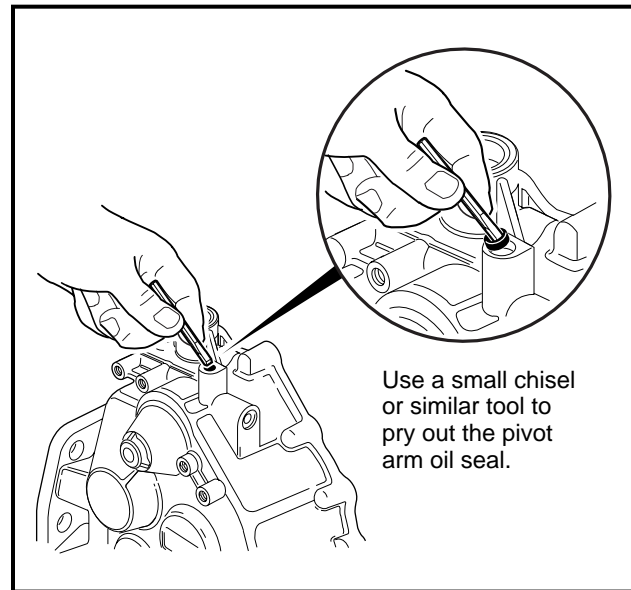


Figure 16-41 Pivot Arm Oil Seal

COMPONENT DISASSEMBLY

Read **DANGER** and **WARNING** on page 16-1.

GOVERNOR GEAR DISASSEMBLY

NOTE

- IT WILL BE NECESSARY TO DISASSEMBLE THE GOVERNOR GEAR ASSEMBLY IN ORDER TO REINSTALL IT INTO THE TRANSAXLE CASE.

1. Secure the governor gear assembly in a vise as shown. Wrap shaft in a cloth to prevent damage (**Figure 16-44, Page 16-19**).
2. Use two small screwdrivers to pry the gear and flyweight off the shaft as shown (**Figure 16-44, Page 16-19**).

DIFFERENTIAL GEAR CASE DISASSEMBLY

⚠ CAUTION

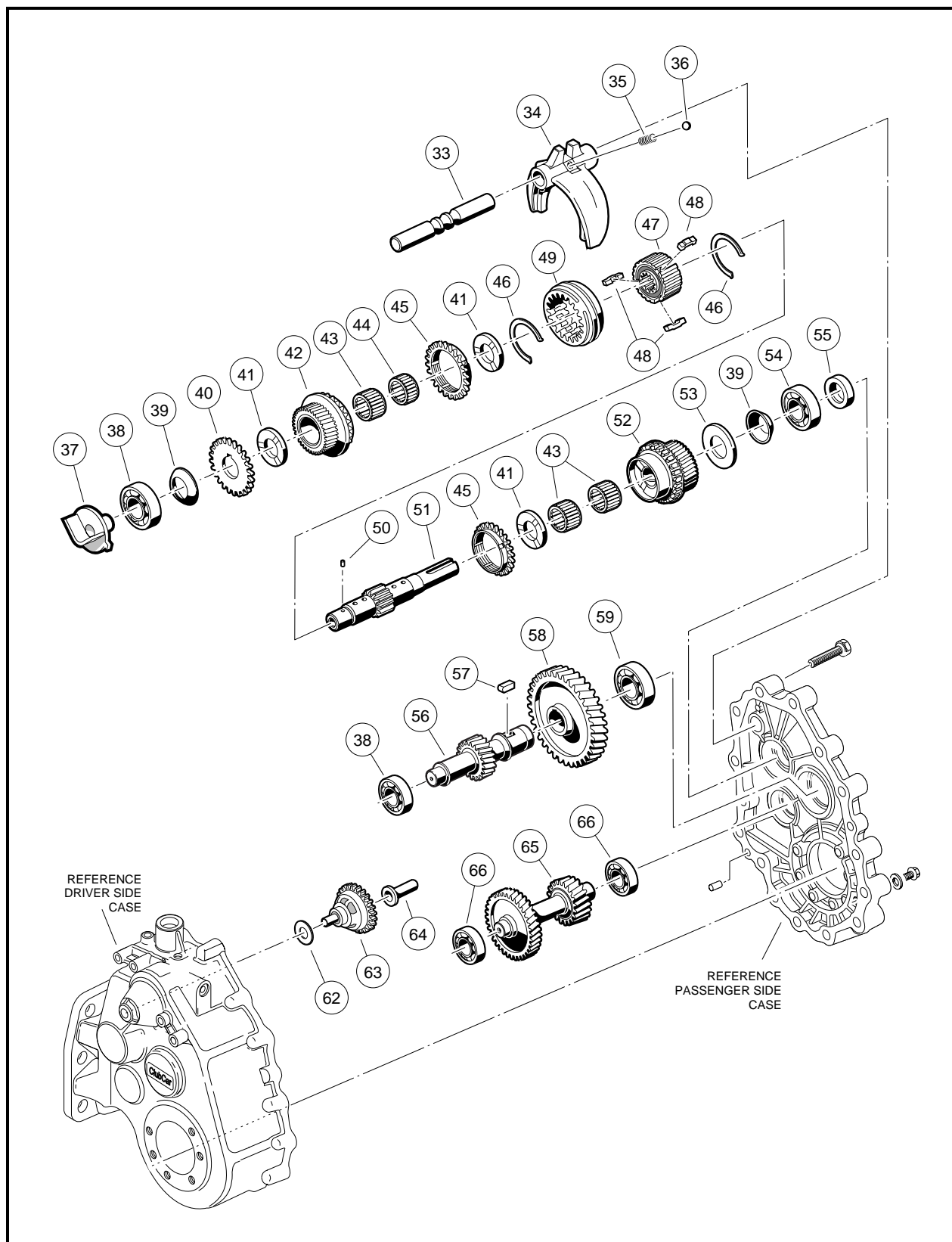
- MARK PARTS FOR IDENTIFICATION AS THEY ARE DISASSEMBLED. PARTS MUST BE REASSEMBLED IN THEIR ORIGINAL LOCATIONS AND ORIENTATIONS.

1. Remove eight ring gear retaining bolts (80) (**Figure 16-5, Page 16-4**), then remove the ring gear from the assembly. It may be necessary to tap the ring gear off with a plastic or rubber mallet (**Figure 16-45, Page 16-19**). See following **NOTE**.

NOTE

- BECAUSE LOCTITE WAS APPLIED TO THE BOLTS DURING ASSEMBLY, IT MAY BE NECESSARY TO PLACE THE DIFFERENTIAL GEAR CASE IN A VISE TO REMOVE THE BOLTS.

2. Pull the cover (87) and thrust plate (86) from the differential gear carrier case (**Figure 16-5, Page 16-4**).

Differential Gear Case Disassembly, Continued:**Figure 16-42 Unitized Transaxle**

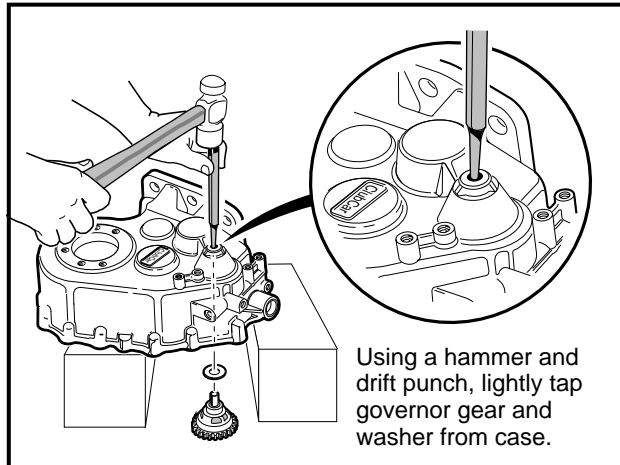


Figure 16-43 Remove Governor Gear

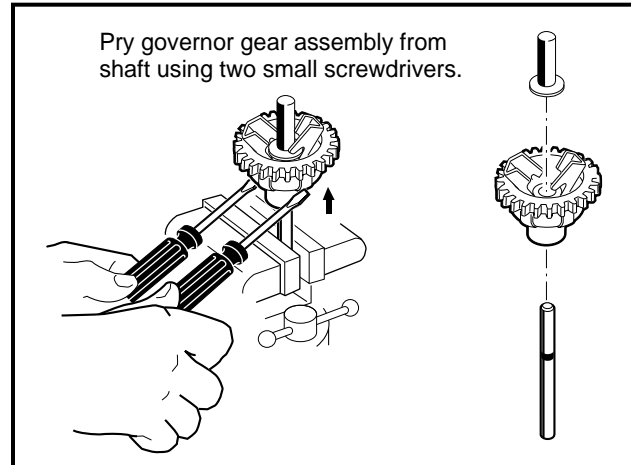


Figure 16-44 Pry Gear from Shaft

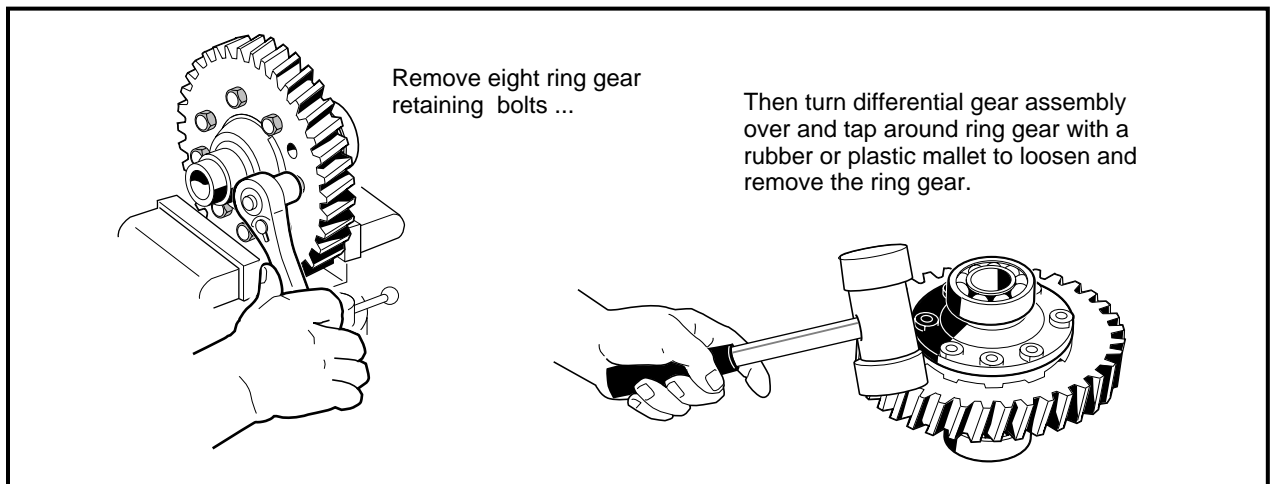


Figure 16-45 Remove Ring Gear

3. Remove the differential gear (90) from the differential gear carrier case (**Figure 16-5, Page 16-4**).
4. Remove the differential pin (88) (**Figure 16-5, Page 16-4**) by pushing it through from one side (**Figure 16-46, Page 16-21**). Remove the two differential idler gears (89) and two idler gear thrust plates (85) (**Figure 16-5, Page 16-4**) as the pin is driven through.

NOTE

- IT MAY BE NECESSARY TO DRIVE THE DIFFERENTIAL PIN OUT WITH HAMMER AND PUNCH.

5. Remove the differential gear (91) from the carrier case (**Figure 16-5, Page 16-4**).
6. If the bearings (79) are to be removed, place a bearing puller wedge attachment (Club Car Part No. 1012812) between the bearing and gear case (84) (**Figure 16-5, Page 16-4**) and press the bearing off as shown (**Figure 16-47, Page 16-21**). Repeat the process for the bearing on the carrier cover (87) (**Figure 16-5, Page 16-4**). See following **CAUTION**.

CAUTION

- DO NOT TIGHTEN THE BEARING PULLER WEDGE ATTACHMENT AGAINST THE SHAFT. THIS COULD DAMAGE THE SHAFT.

SHIFTER FORK DISASSEMBLY

1. Push the shift rod (33) out of the shifter fork (34) **(Figure 16-42, Page 16-18)**.
2. Shake the shifter fork to remove the spring (35) and ball (36) **(Figure 16-42, Page 16-18)**.

SYNCHRONIZER GEAR DISASSEMBLY

CAUTION

- MARK PARTS FOR IDENTIFICATION AS THEY ARE DISASSEMBLED. PARTS MUST BE REASSEMBLED IN THEIR ORIGINAL LOCATIONS AND ORIENTATIONS.
- DO NOT TIGHTEN THE BEARING PULLER WEDGE ATTACHMENT AGAINST THE SHAFT. THIS COULD DAMAGE THE SHAFT.

1. Place a bearing puller wedge attachment (Club Car Part No. 1012812) between the bearing (38) and spur (governor drive) gear (40) **(Figure 16-42, Page 16-18)**, then press the bearing off the input shaft as shown **(Figure 16-48, Page 16-21)**. See preceding CAUTION.
2. Pull the spring washer (39), spur gear (40), dowel pin (50), thrust plate (41), input gear assembly (42), large needle bearing (43), small needle bearing (44), synchronizer ring (45), and thrust plate (41) from the input shaft **(Figure 16-42, Page 16-18)**.
3. Place a bearing puller wedge attachment (Club Car Part No. 1012812) between the bearing (54) and input gear assembly (52) **(Figure 16-42, Page 16-18)**, then press the bearing off the input shaft as shown **(Figure 16-49, Page 16-21)**. See following CAUTION.

CAUTION

- DO NOT TIGHTEN THE BEARING PULLER WEDGE ATTACHMENT AGAINST THE SHAFT. THIS COULD DAMAGE THE SHAFT.

4. Pull the spring washer (39), thrust washer (53), input gear assembly (52), two needle bearings (43), thrust plate (41), and synchronizer ring (45) from the input shaft **(Figure 16-42, Page 16-18)**.
5. Use a small flat-blade screwdriver to remove two synchronizer springs (snap rings) (46), and then slide the synchronizer clutch hub (49) from the input shaft (51) **(Figure 16-42, Page 16-18)**.

NOTE

- THERE ARE THREE SYNCHRONIZER INSERTS (48) SET INTO SLOTS IN THE SYNCHRONIZER SLEEVE (47) **(FIGURE 16-42, PAGE 16-18)**. THESE MAY FALL FREE WHEN THE SYNCHRONIZER CLUTCH HUB (49) IS REMOVED. DO NOT LOSE THESE INSERTS.

6. Remove the three synchronizer inserts (48) from the synchronizer sleeve **(Figure 16-42, Page 16-18)**.
7. Press the synchronizer sleeve (47) from the input shaft **(Figure 16-42, Page 16-18)**.

INTERMEDIATE GEAR DISASSEMBLY

1. Place bearing puller wedge attachment (Club Car Part No. 1012812) between bearing (38) and shaft/gear (56) **(Figure 16-42, Page 16-18)**, then press bearing off shaft **(Figure 16-50, Page 16-22)**. See following CAUTION.

CAUTION

- DO NOT TIGHTEN THE BEARING PULLER WEDGE ATTACHMENT AGAINST THE SHAFT. THIS COULD DAMAGE THE SHAFT.

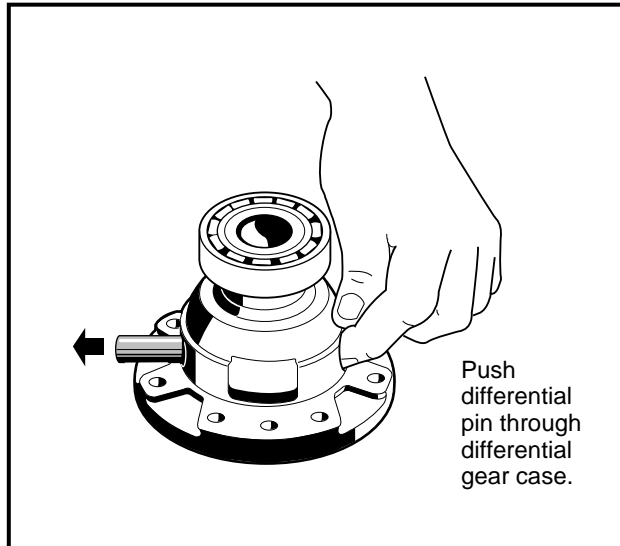


Figure 16-46 Differential Pin

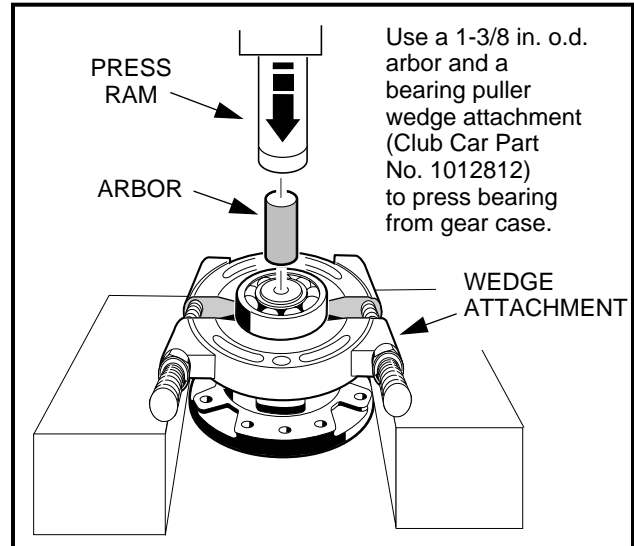


Figure 16-47 Remove Bearing

2. Place the bearing puller wedge attachment under the bearing (59) and press the bearing from the shaft (**Figure 16-42, Page 16-18**). See following **CAUTION**.
3. Press the gear (58) from the shaft (56), then remove the key (57) (**Figure 16-42, Page 16-18**).

IDLER SHAFT DISASSEMBLY

1. Place a bearing puller wedge attachment (Club Car Part No. 1012812) between the bearing (66) and the small gear on the idler shaft (65) (**Figure 16-42, Page 16-18**), then press the bearing off the shaft as shown (**Figure 16-51, Page 16-22**). See following **CAUTION**.

⚠ CAUTION

- DO NOT TIGHTEN THE BEARING PULLER WEDGE ATTACHMENT AGAINST THE SHAFT. THE SHAFT COULD BE DAMAGED WHEN PRESSING THE BEARING OFF.

2. Place a bearing puller wedge attachment (Club Car Part No. 1012812) between the bearing and the larger gear on the idler shaft (65) (**Figure 16-42, Page 16-18**), then press the bearing off the shaft as shown (**Figure 16-52, Page 16-22**).

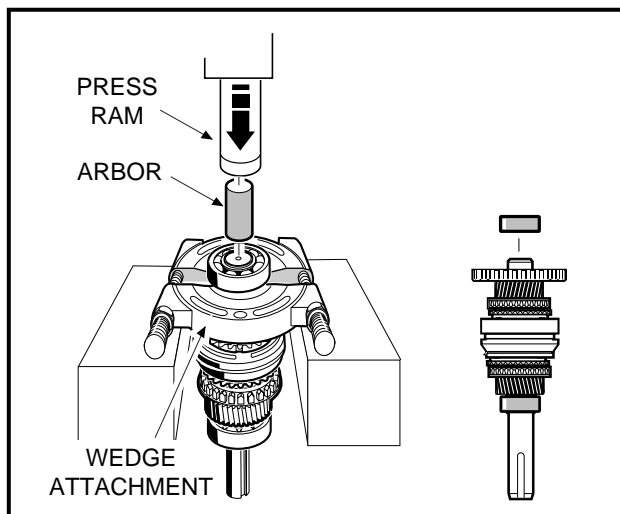


Figure 16-48 Remove Bearing

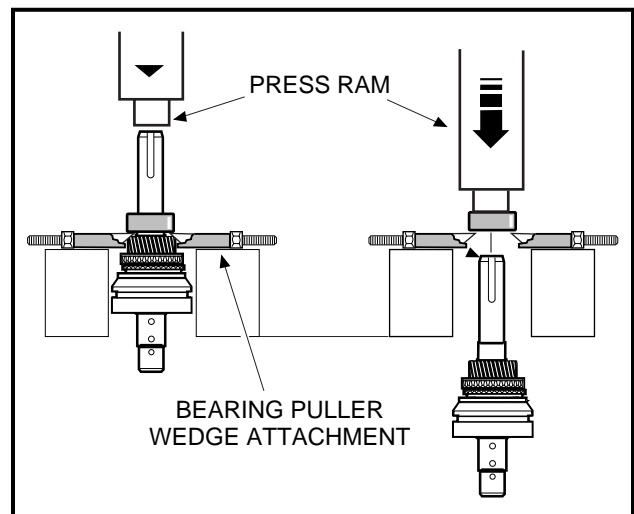


Figure 16-49 Remove Bearing

UNITIZED TRANSAXLE COMPONENT INSPECTION

Read **DANGER** and **WARNING** on page 16-1.

1. Clean all of the component parts of the transaxle in a high flash-point solvent and then dry them. Inspect all components for excessive wear or damage.
2. Inspect all bearings by spinning them by hand. Check the bearings for excessive axial (A) and radial (B) play (**Figure 16-53, Page 16-22**). Replace bearings if they do not spin smoothly, if they are noisy, or if they have excessive play. Replace bearings if they are rusted, worn, cracked, pitted, or discolored.
3. Gears should be inspected for tooth surface damage or fractures.
4. Synchronizer ring teeth should be inspected for severe wear, fractures, or other damage.
5. Using a feeler gauge, measure the distance X at several points around the assembly. The synchro ring should be replaced when X is 0.02 inch (0.5 mm) or less (**Figure 16-54, Page 16-23**).

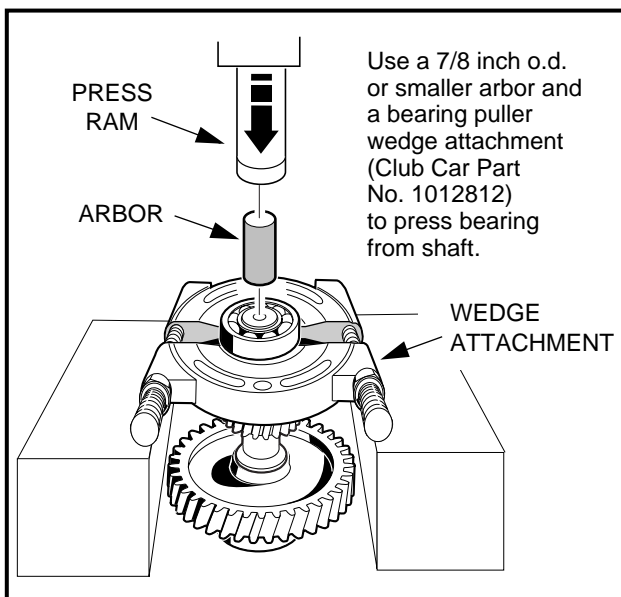


Figure 16-50 Remove Bearing

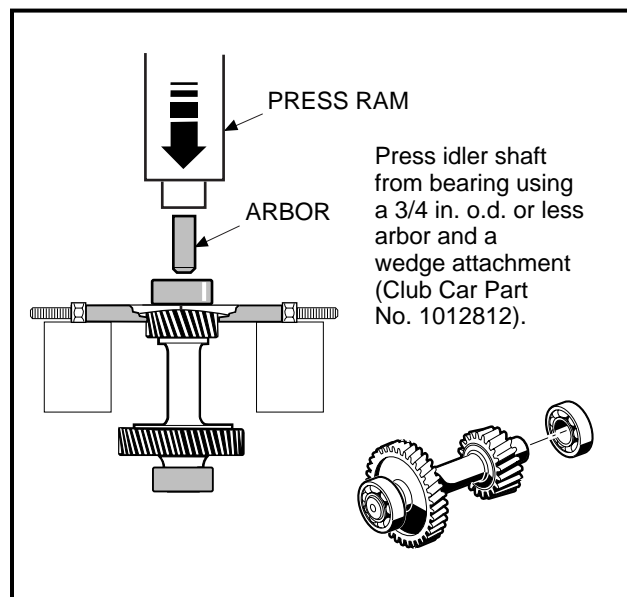


Figure 16-51 Remove Bearing

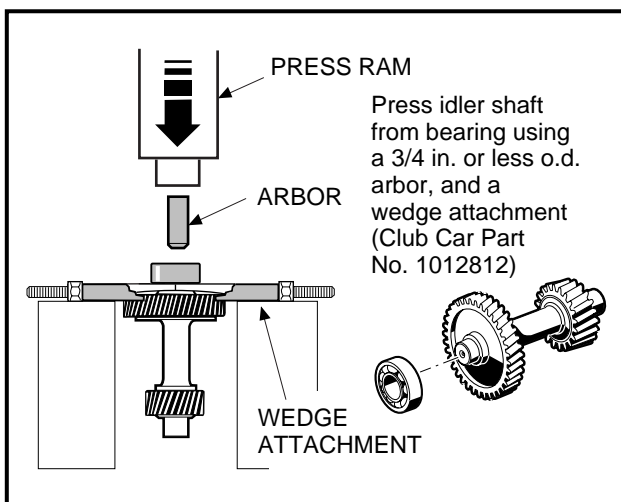


Figure 16-52 Remove Idler Shaft

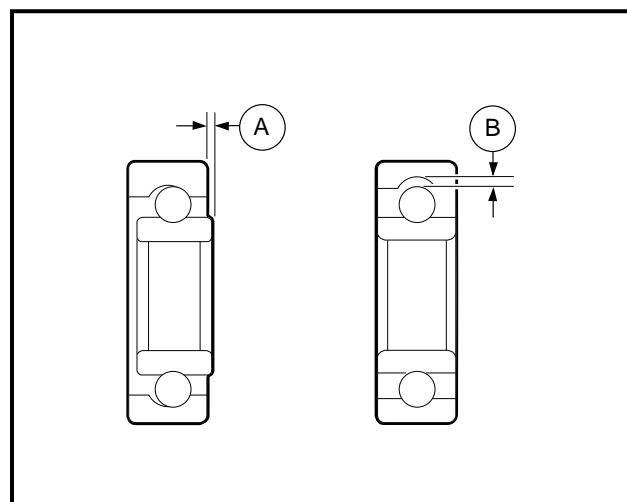


Figure 16-53 Inspect Bearings

COMPONENT ASSEMBLY

Read **DANGER** and **WARNING** on page 16-1.

IDLER SHAFT ASSEMBLY

1. Press a new bearing (66) (**Figure 16-42, Page 16-18**) onto each end of the idler shaft (**Figure 16-55, Page 16-23**). See following **CAUTION**.

⚠ CAUTION

- APPLY PRESSURE AGAINST THE INNER RACE OF THE BEARING ONLY. APPLYING PRESSURE ANYWHERE ELSE WILL DAMAGE THE BEARING.

INTERMEDIATE GEAR ASSEMBLY

1. If the gear (58) was removed from the shaft, install the key (57) into the slot and then position the gear on the shaft with keyway properly aligned with key. Press gear into place on the key (**Figure 16-42, Page 16-18**).
2. Press the bearing (59) onto the end of the shaft next to the large gear that was installed in step one (**Figure 16-42, Page 16-18**). See preceding **CAUTION**.
3. Press a new bearing (38) onto the other end of the shaft (**Figure 16-42, Page 16-18**).

SYNCHRONIZER GEAR ASSEMBLY

1. Press the synchronizer sleeve (47) onto the splines of the input shaft (51) (**Figure 16-42, Page 16-18**). No particular orientation of the sleeve is necessary, but toward the short end of the shaft, the machined circular face surrounding the ends of the internal splines in the sleeve must be flush with the machined lip of the shaft at the ends of the shaft splines (**Figure 16-56, Page 16-24**).
2. Install the synchronizer springs (46) (**Figure 16-42, Page 16-18**) in the sleeve as shown (**Figure 16-57, Page 16-24**).

NOTE

- MAKE SURE THE ENDS OF THE SPRINGS ARE POSITIONED BETWEEN THE SYNCHRONIZER INSERT SLOTS (**FIGURE 16-57, PAGE 16-24**).

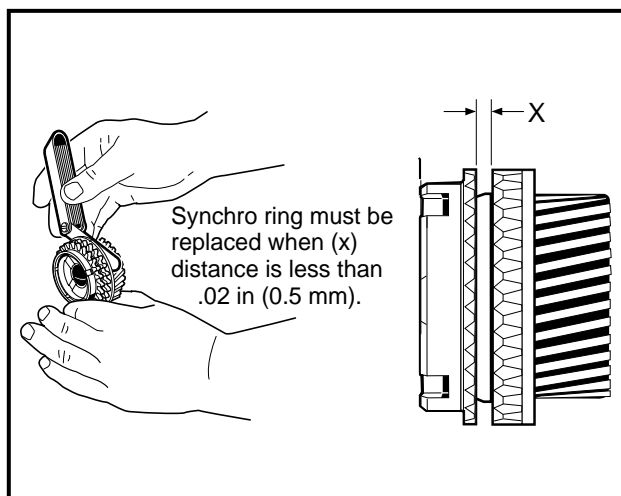


Figure 16-54 Synchro. Ring

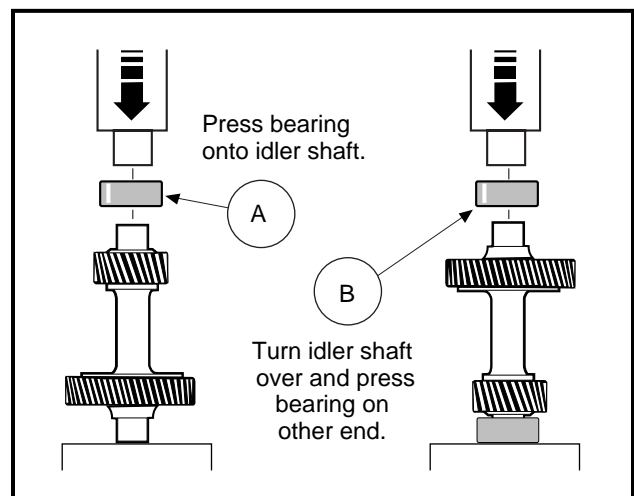
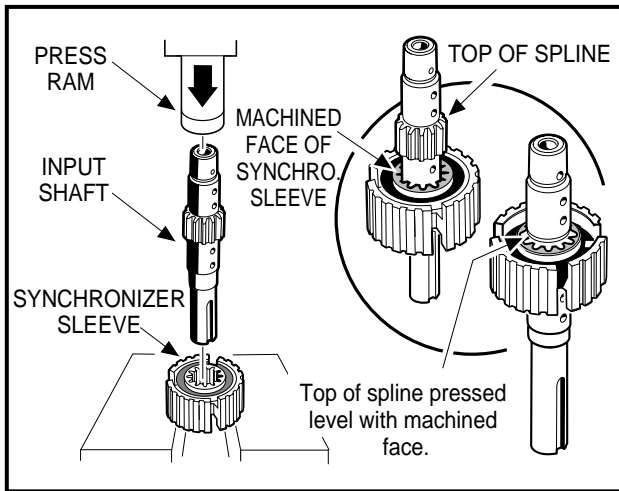
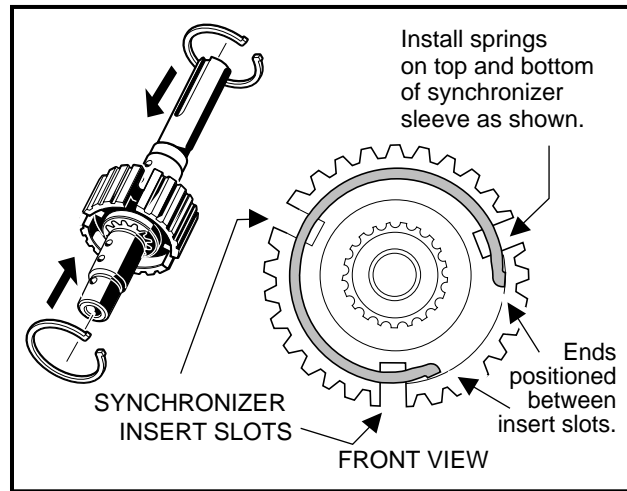


Figure 16-55 Idler Shaft

Synchronizer Gear Assembly, Continued:**Figure 16-56 Synchro. Gear Assembly****Figure 16-57 Synchro. Springs**

3. Install the three synchronizer inserts (48) into the slots in the sleeve (**Figure 16-42, Page 16-18**). Make sure the notched surfaces of the inserts are facing outward as shown (**Figure 16-58, Page 16-25**).
4. Install the synchronizer clutch hub (49) (**Figure 16-42, Page 16-18**) onto the synchronizer sleeve. Make sure the chamfered end of the hub is oriented toward the long end of the input shaft as shown (**Figure 16-59, Page 16-25**).
5. On the long end of the shaft, install the synchronizer ring (45) (**Figure 16-42, Page 16-18**) with the smooth collar of the ring towards the clutch hub. Make sure the three notches in the collar mate with the synchronizer inserts in the synchronizer sleeve as shown (**Figure 16-60, Page 16-25**).
6. Install the thrust washer (41) and two bearings (43) as shown (**Figure 16-42, Page 16-18**).
7. Install the input gear assembly (52), with the smooth collar toward the synchronizer ring as shown (**Figure 16-42, Page 16-18**). The input gear should seat in the synchronizer ring.
8. Install the thrust washer (53) and then the spring washer (39). The spring washer should be oriented with the raised center toward the end of the shaft (**Figure 16-42, Page 16-18**).
9. Press new bearing (54) (**Figure 16-42, Page 16-18**) onto the shaft until it seats. Make sure the input gear turns freely. **See following CAUTION.**

CAUTION

- APPLY PRESSURE AGAINST THE INNER RACE OF THE BEARING ONLY. APPLYING PRESSURE ANYWHERE ELSE WILL DAMAGE THE BEARING.

10. On the other end of the input shaft, install the thrust washer (41), and the synchronizer ring (45). The smooth collar of the synchronizer ring should be oriented toward the clutch hub, and the notches in it should mate with the synchronizer inserts as shown (**Figure 16-42, Page 16-18**).
11. Install the narrow bearing (44), wide bearing (43), and input gear (42) onto the shaft. The smooth collar of the input gear should be oriented toward the synchronizer ring as shown (**Figure 16-42, Page 16-18**). The gear should seat inside the ring.
12. Install thrust plate (41) onto the shaft, and the dowel pin (50) into the shaft as shown (**Figure 16-42, Page 16-18**).
13. Install the spur (governor drive) gear (40) onto the shaft with either side down. Mate the notch in the gear with the dowel pin as shown (**Figure 16-42, Page 16-18**).

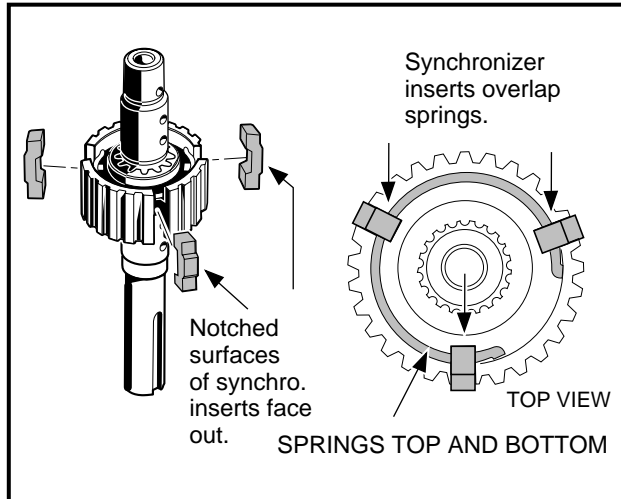


Figure 16-58 Synchronizer Inserts

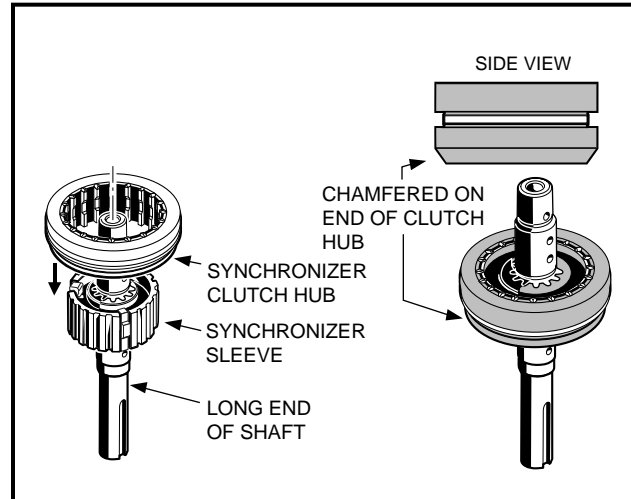


Figure 16-59 Synchronizer Clutch Hub

14. Install the spring washer (39) onto shaft with the raised center toward the end of the shaft (**Figure 16-42, Page 16-18**).
15. Press a new bearing (38) onto the end of the shaft until it seats (**Figure 16-42, Page 16-18**). Make sure the input gears turn freely. **See following CAUTION.**

⚠ CAUTION

- APPLY PRESSURE AGAINST THE INNER RACE OF THE BEARING ONLY. APPLYING PRESSURE ANYWHERE ELSE WILL DAMAGE THE BEARING.

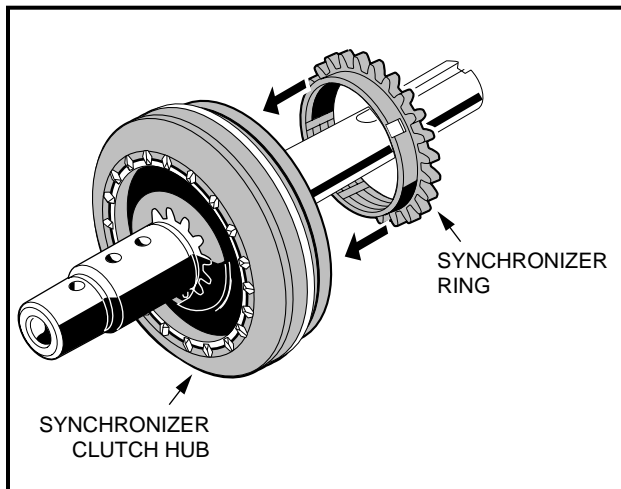


Figure 16-60 Synchro. Ring

SHIFTER FORK ASSEMBLY

1. Install the spring (35) and ball (36) into the shifter fork (34) as shown (**Figure 16-42, Page 16-18**).
2. Use a No. 1 tip phillips screwdriver to depress the ball and spring while inserting shift rod (33) into the shifter fork (34). Remove screwdriver when the shift rod is inserted far enough for it to depress the ball and spring, then continue to insert rod until the ball is positioned in the middle detent on the rod (**Figure 16-42, Page 16-18**).

DIFFERENTIAL GEAR CASE ASSEMBLY

1. If the bearings (79) were removed, press new ones onto the differential gear carrier case (84) and carrier case cover (87) (**Figure 16-5, Page 16-4**). See following **CAUTION**.

⚠ CAUTION

- APPLY PRESSURE AGAINST THE INNER RACE OF THE BEARING ONLY. APPLYING PRESSURE ANYWHERE ELSE WILL DAMAGE THE BEARING.

2. Install differential gear (91) into carrier case (84) (**Figure 16-5, Page 16-4**) as shown (**Figure 16-61, Page 16-26**).
3. Start the differential pin (88) into the carrier case by lightly tapping it in with a plastic or rubber hammer. Before the pin enters the inside of the carrier case, position the thrust plate (85) and idler gear (89) (**Figure 16-5, Page 16-4**) in the case and then continue tapping the pin through the thrust plate and idler gear as shown (**Figure 16-62, Page 16-26**).
4. Position the other thrust plate (85) and idler gear (89) (**Figure 16-5, Page 16-4**) in the carrier case. Then continue to drive the pin through them and the wall of the carrier case until the ends of the pin are flush with the sides of the carrier case (**Figure 16-63, Page 16-27**).
5. Install the thrust plate (86) and differential gear (90) into the carrier case cover (87) (**Figure 16-5, Page 16-4**) as shown (**Figure 16-64, Page 16-27**). Then, while holding the thrust plate and differential gear in place, position the carrier case cover on the carrier case (**Figure 16-64, Page 16-27**).
6. Position the output ring gear (81) (**Figure 16-5, Page 16-4**) on the carrier case, visually aligning the dowel hole in the carrier case with the dowel pin in the ring gear. Then, using a plastic or rubber mallet, tap the ring gear into place on the dowel pin as shown (**Figure 16-65, Page 16-27**).
7. Apply Loctite 277 on the threads of the eight mounting bolts and install them through the ring gear, carrier case, and into the carrier case cover. Tighten the bolts to 18 ft-lb (24.4 N·m) in the sequence shown (**Figure 16-66, Page 16-27**).

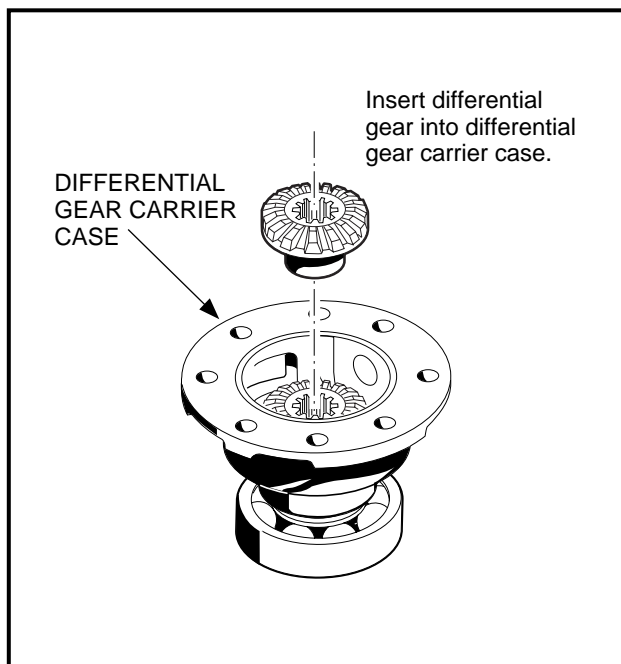


Figure 16-61 Differential Gear

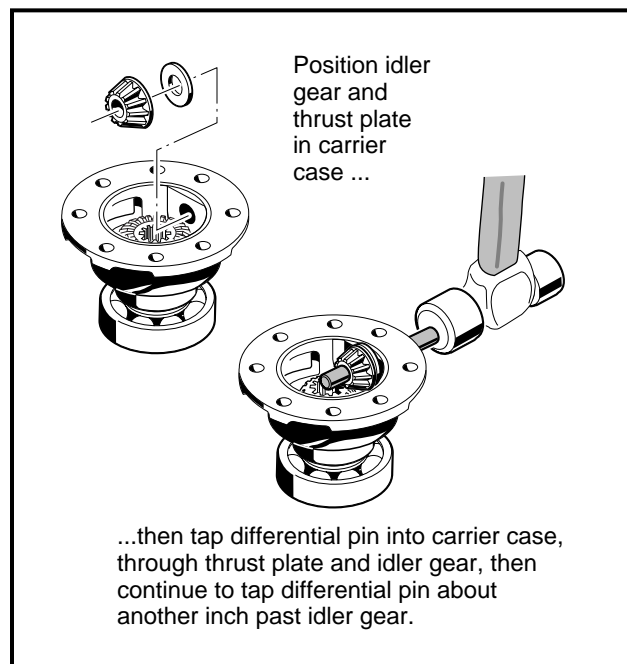


Figure 16-62 Idler Gear

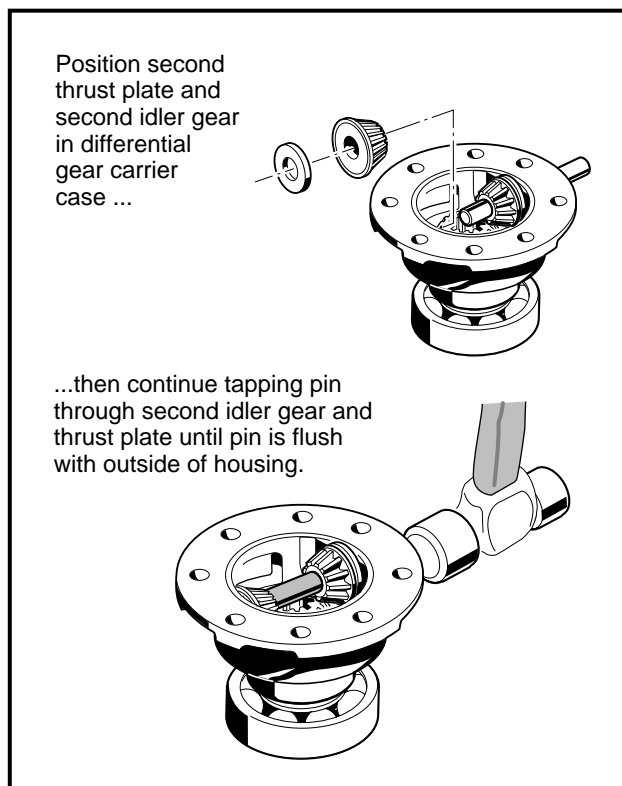


Figure 16-63 Second Idler Gear

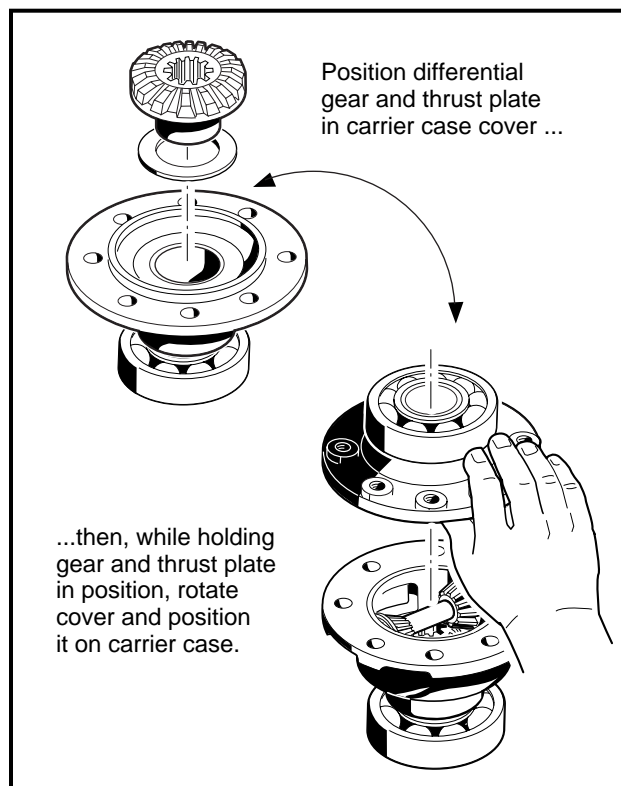


Figure 16-64 Carrier Case

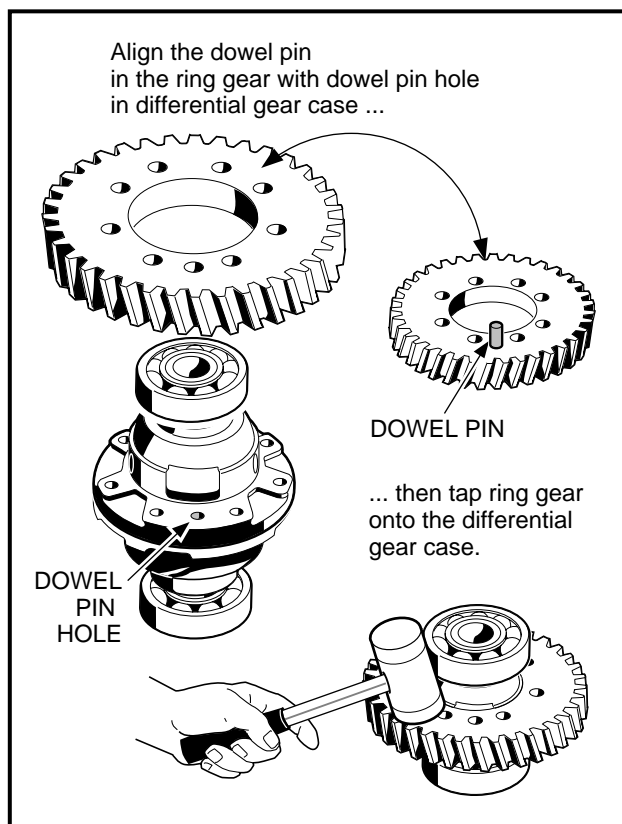


Figure 16-65 Ring Gear

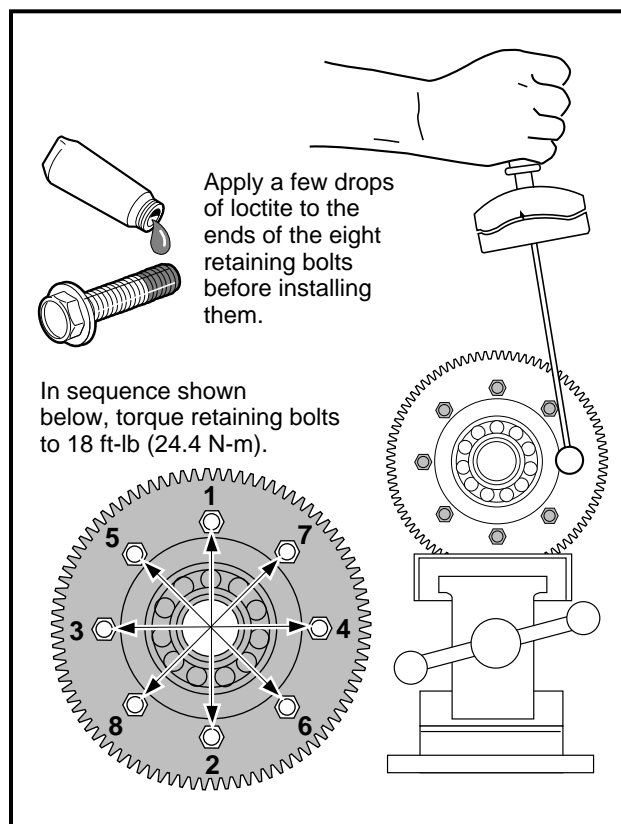


Figure 16-66 Retaining Bolts

GOVERNOR GEAR ASSEMBLY

The governor gear is not assembled before installing it in the unitized transaxle case. The governor gear shaft is installed into the case and then the rest of the governor gear assembly is installed on the shaft. Proceed with unitized transaxle assembly.

UNITIZED TRANSAXLE ASSEMBLY

Read **DANGER** and **WARNING** on page 16-1.

NOTE

- ALTHOUGH THE FOLLOWING DRAWINGS SHOW THE TRANSAXLE BEING ASSEMBLED IN AN UPRIGHT POSITION, LAYING THE TRANSAXLE ON ITS LEFT (DRIVER) SIDE WILL SIMPLIFY THE ASSEMBLY PROCESS.

1. Make sure both parts of the case are clean and free of any contaminants. Make sure the machined mating surfaces are free of residue and are not scratched or damaged in any way.
2. Put a light coating of clean transmission oil on the outside edge of the seal to make installation easier. Press two new oil seals (13 and 22) (**Figure 16-35, Page 16-14**) into the left (driver) side case. Use an oil seal installation tool (Club Car Part No. 1014160) to install a new oil seal (55) (**Figure 16-42, Page 16-18**) into the right (passenger side) case. **See also Figure 16-67, Page 16-29.**
3. Position the governor gear shaft installation tool (Club Car Part No. 101933101) over the shaft bore in the inside of the left (driver) side case and insert the governor gear shaft into the tool, long end (from the groove) first, as shown (**Figure 16-68, Page 16-29**). Make sure the shaft is started into the bore and then, using a plastic or rubber hammer, carefully tap the governor gear shaft into the bore until the end being tapped is flush with the end of the tool. Remove installation tool.
4. Install the washer, governor gear, and sleeve together onto the governor shaft (**Figure 16-69, Page 16-30**). Make sure the sleeve is properly positioned within the flyweight brackets of the gear as shown (**Figure 16-70, Page 16-30**), and then push them onto the shaft until the gear snaps into the groove on the shaft.
5. Position the interior washer on the pivot arm, then install the pivot arm and washer into the left (driver side) case as shown (**Figure 16-71, Page 16-30**). Install the exterior washer and cotter pin on the pivot arm outside the case as shown (**Figure 16-71, Page 16-30**). Bend the legs of the cotter pin.
6. Install the shifter shaft into the left (driver side) case as shown (**Figure 16-72, Page 16-30**). Then install the washer and using external snap ring pliers (.070 tip), install retaining ring on the shifter shaft outside of the case (**Figure 16-72, Page 16-30**). Make sure the retaining ring is in the groove of the shaft.
7. Install the gear assemblies into the left (driver side) case.
 - 7.1. Stand the left side case on the mounting plate, then install the differential gear case assembly as shown (**Figure 16-73, Page 16-31**). Do not seat the assembly in the bore, but insert it just far enough that it will not fall out.
 - 7.2. Install the idler gear assembly into case as shown. Do not seat the assembly in the bore, but insert far enough that it will not fall out. No gears mesh at this time (**Figure 16-75, Page 16-31**).
 - 7.3. Install the oil guide with the baffle toward the case wall as shown (**Figure 16-75, Page 16-31**). Make sure the two tabs on the guide are positioned in the slots in the case.
 - 7.4. Position the shifter fork assembly on the synchronizer gear assembly as shown, and install them together, bearing end first, into the bore containing the oil guide (**Figure 16-76, Page 16-31**). Do not seat the assembly, but make sure the spur gear (40) is meshed with the governor gear (63) (**Figure 16-42, Page 16-18**), and the shifter lever (14) (**Figure 16-35, Page 16-14**) is positioned in the bracket on the shifter fork. **See also Figure 16-77, Page 16-32.**

- 7.5. Install the intermediate gear assembly into the case as shown (**Figure 16-78, Page 16-32**). Do not seat the assembly into the bore, but make sure the output ring gear meshes with the input drive gear (52) (**Figure 16-42, Page 16-18**) on the synchronizer gear assembly, and with the small gear on the idler shaft (65) (**Figure 16-42, Page 16-18**).
- 7.6. As a group and while keeping the gears meshed, work all of the gear assemblies into the bores until they are seated. When all of the assemblies are correctly seated, the outside edges of the input drive gear (52) and the intermediate gear (58) (**Figure 16-42, Page 16-18**) should be flush (in the same plane) as shown (**Figure 16-79, Page 16-33**). Also, the outside surfaces of the idler gear bearing, the intermediate gear bearing, and the differential gear bearing should be flush (**Figure 16-79, Page 16-33**). See following **CAUTION**.

⚠ CAUTION

- IF THE EDGES OF THE INPUT DRIVE GEAR AND INTERMEDIATE GEAR ARE NOT FLUSH, THEN THE OIL GUIDE (37) (**FIGURE 16-42, PAGE 16-18**) MAY NOT BE PROPERLY POSITIONED IN THE BORE.

8. Make sure the mating surfaces of the left and right sides of the case are clean and free of oil, grease, or residue of any kind, and they are not scratched or damaged in any way.
9. Apply a continuous bead of Three Bond No. 1215 (Club Car Part No. 101928701) sealant to the mating surface, around the complete profile of the right (passenger side) case (**Figure 16-80, Page 16-33**). See following **CAUTION**.

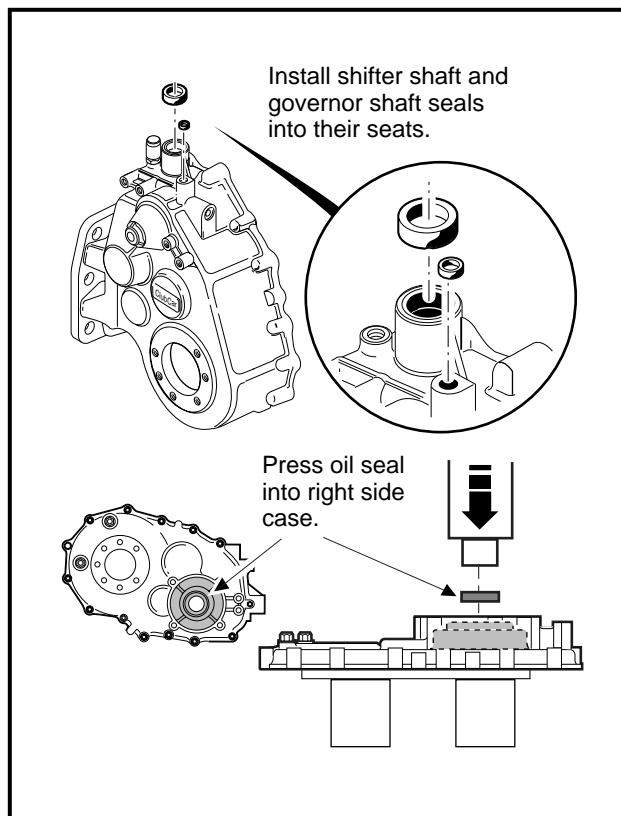


Figure 16-67 Install Seals

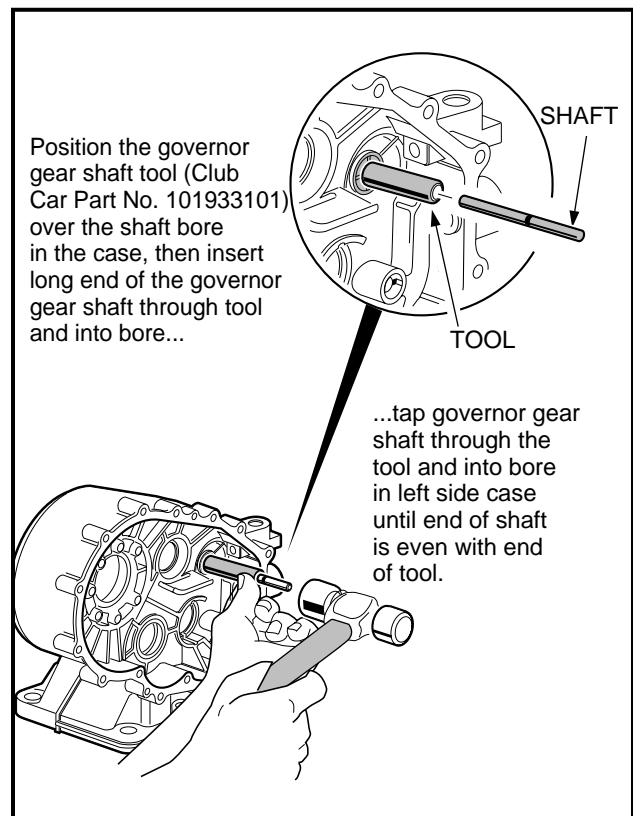


Figure 16-68 Governor Gear Shaft

Unitized Transaxle Assembly, Continued:

CAUTION

- USE ONLY THREE BOND NO. 1215 SEALANT TO SEAL CASE. DO NOT USE A SUBSTITUTE.
- IF THE TWO SIDES OF THE CASE CANNOT BE EASILY CLOSED OR DO NOT MAKE COMPLETE CONTACT, DO NOT FORCE THEM TOGETHER. CHECK THAT ALL INTERNAL COMPONENTS ARE PROPERLY SEATED AND THEN TRY AGAIN.

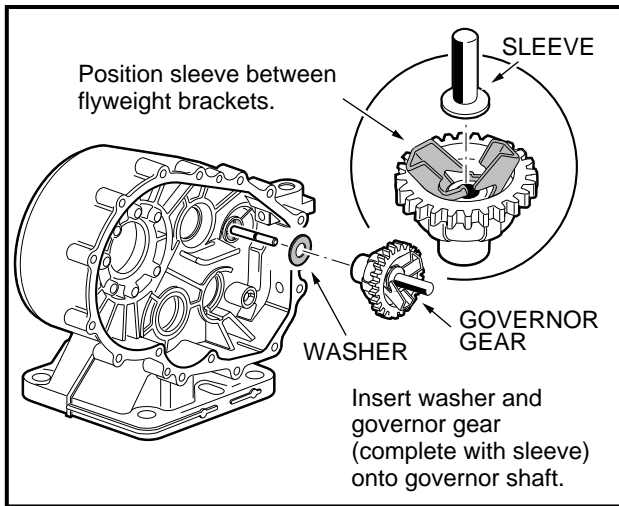


Figure 16-69 Position Governor Gear

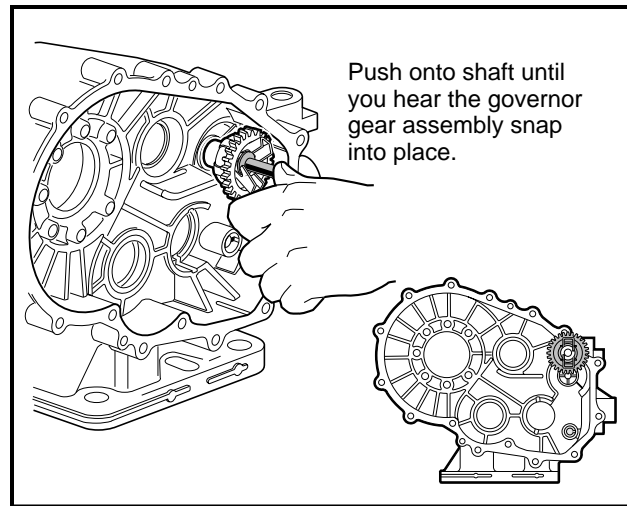


Figure 16-70 Install Governor Gear

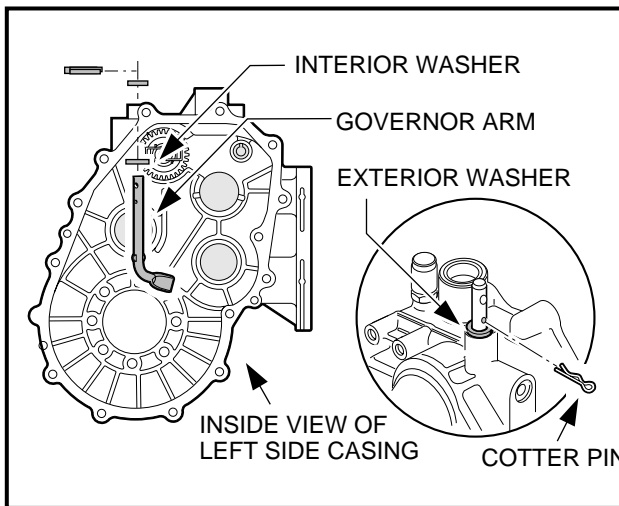


Figure 16-71 Pivot Arm

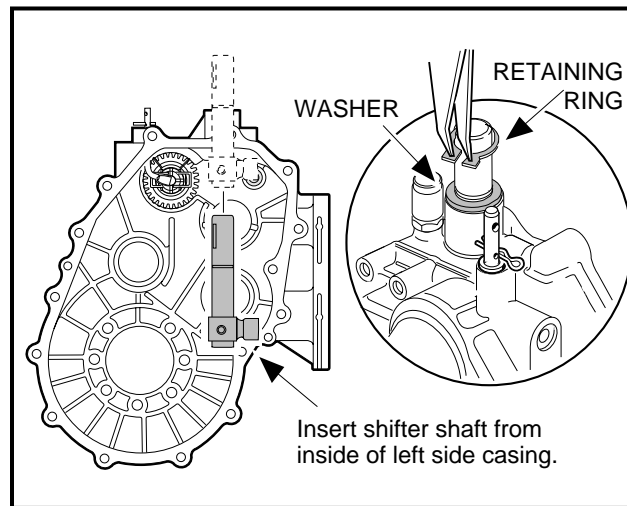


Figure 16-72 Insert Shifter Shaft

10. Install and finger tighten the fifteen bolts (27) (**Figure 16-35, Page 16-14**) that secure the left and right sides of the case together. Then, in sequence shown, tighten the bolts to 17 ft-lb (23.1 N·m) (**Figure 16-81, Page 16-33**).
11. Install axle tubes (75 and 76) and brake cluster assemblies (if removed) on the transaxle case (**Figure 16-5, Page 16-4**).
 - 11.1. Make sure the mating surfaces of the axle tubes and the transaxle case are clean and free of oil, grease, or residue of any kind.

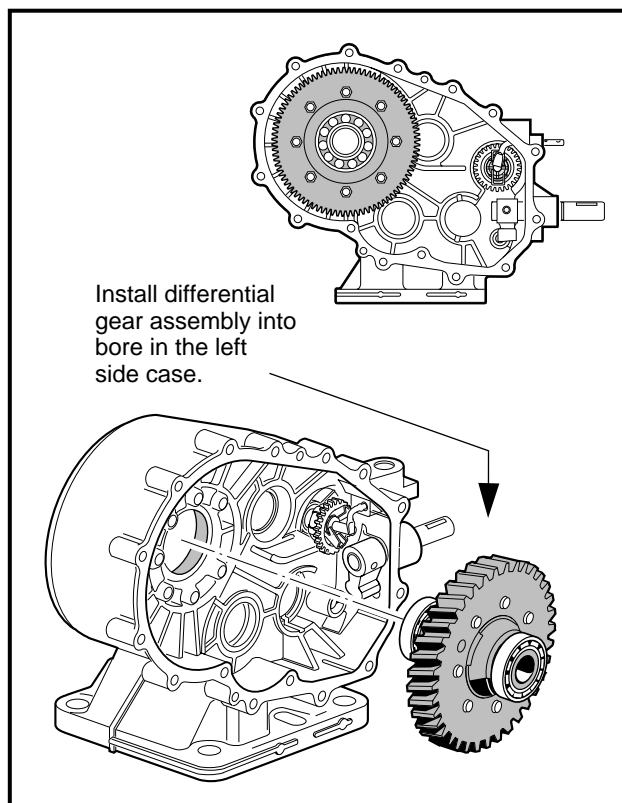


Figure 16-73 Differential Gear Assembly

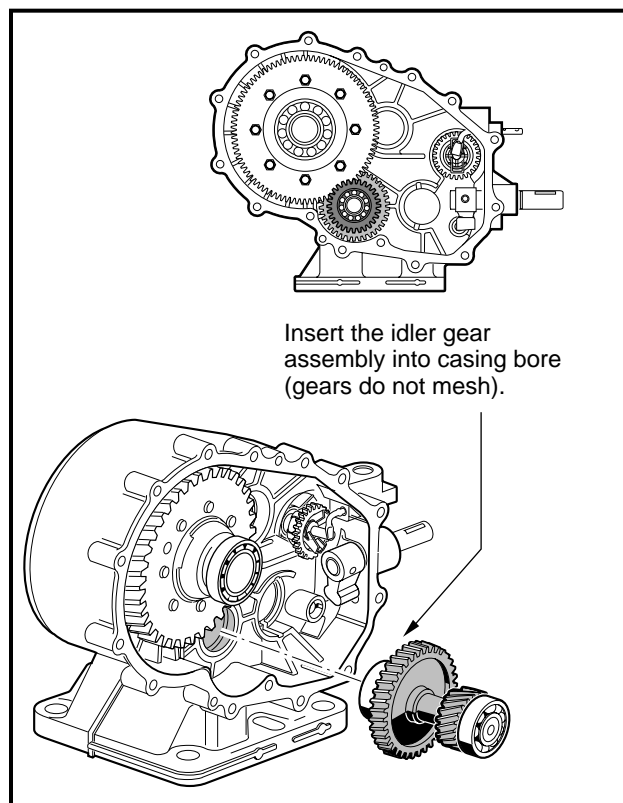


Figure 16-74 Idler Gear Assembly

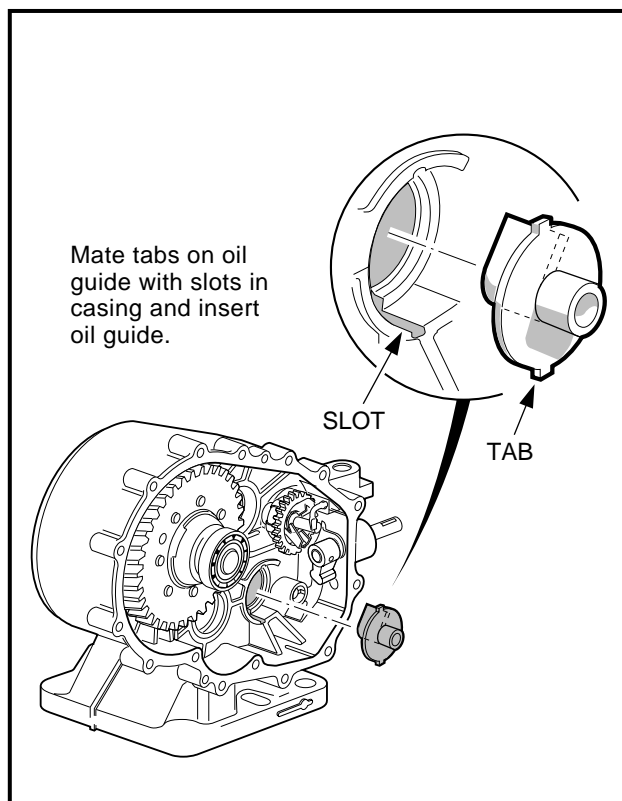


Figure 16-75 Oil Guide

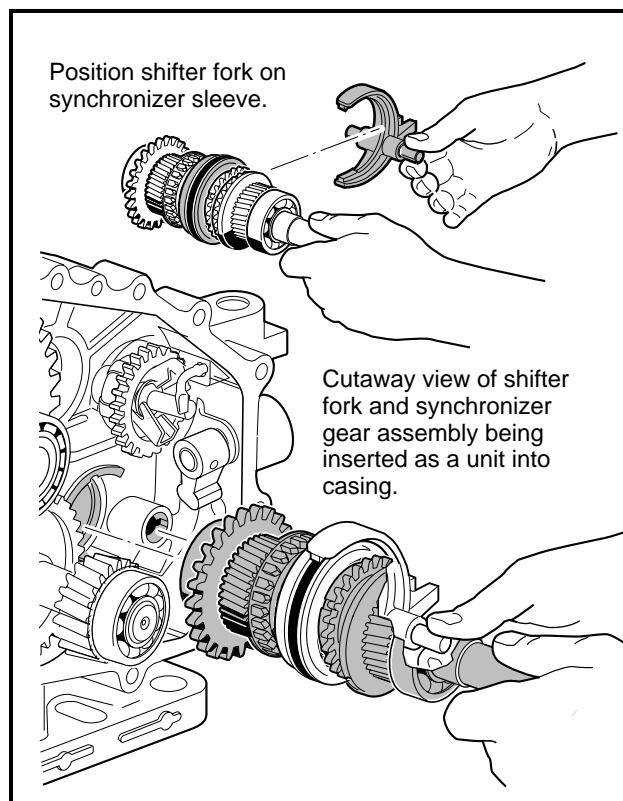


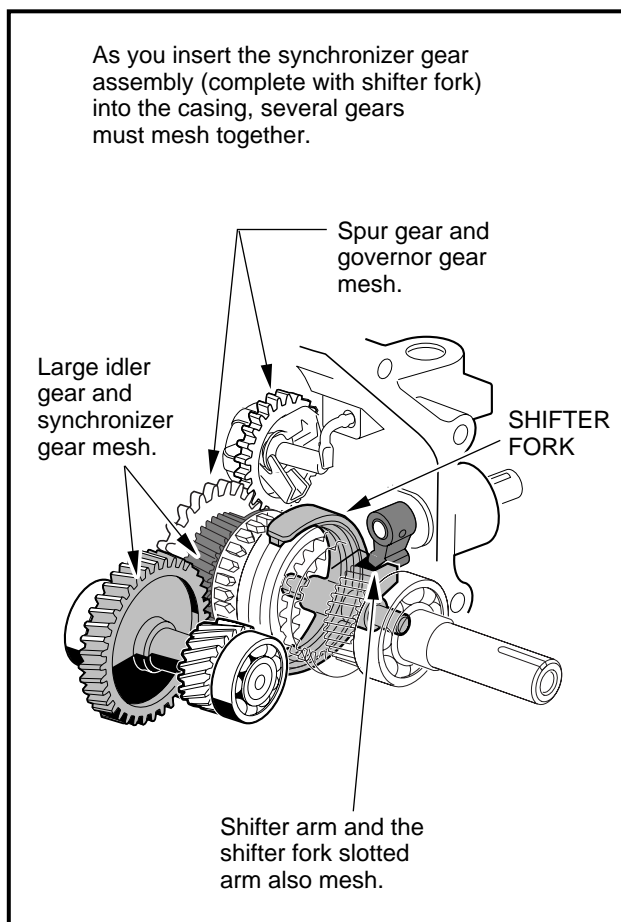
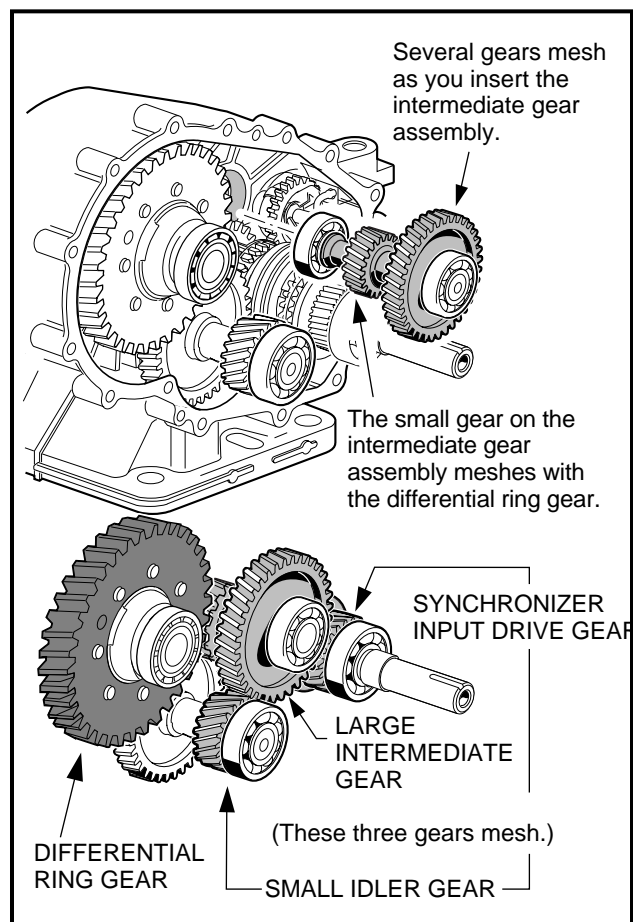
Figure 16-76 Synchronizer Ring Gear

Unitized Transaxle Assembly, Continued:

- 11.2. Apply a continuous bead of Three Bond No. 1215 (Club Car Part No. 101928701) around the opening on the mating surface of the right (passenger) side axle tube as shown (**Figure 16-82, Page 16-33**). Then position the axle tube on the right side of the transaxle case as shown and install seven mounting bolts (77) with lock washers (78) (**Figure 16-5, Page 16-4**) finger tight. In the sequence shown, tighten the bolts to 36 ft-lb (48.8 N·m) (**Figure 16-83, Page 16-34**).
- 11.3. Duplicate step 11.2 for the left (driver) side axle tube.
- 11.4. If removed prior to disassembly, install left and right brake cluster assemblies to the axle tubes. **See Section 6 – Wheel Brake Assemblies in the maintenance and service manual.**
- 11.5. Install the right (passenger side) axle shaft (68) in the right axle tube (76) (**Figure 16-5, Page 16-4**). Using 90° angle (.90 tip) snap ring pliers, install the retaining ring as shown (**Figure 16-84, Page 16-34**). **See following WARNING.**

⚠ WARNING

- BE SURE THE RETAINING RING IS PROPERLY SEATED IN ITS GROOVE. IF THE RING IS NOT PROPERLY INSTALLED, THE AXLE ASSEMBLY WILL SEPARATE FROM THE TRANSAXLE AND DAMAGE THE AXLE ASSEMBLY AND OTHER COMPONENTS. LOSS OF VEHICLE CONTROL COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.

**Figure 16-77 Gear Alignment****Figure 16-78 Gear Alignment**

- 11.6. Install the left (driver side) axle shaft (67) in the left axle tube (75) (**Figure 16-5, Page 16-4**). Using 90° angle (.090 tip) snap ring pliers, install the retaining ring as shown (**Figure 16-84, Page 16-34**). See **WARNING** on page 16-32.

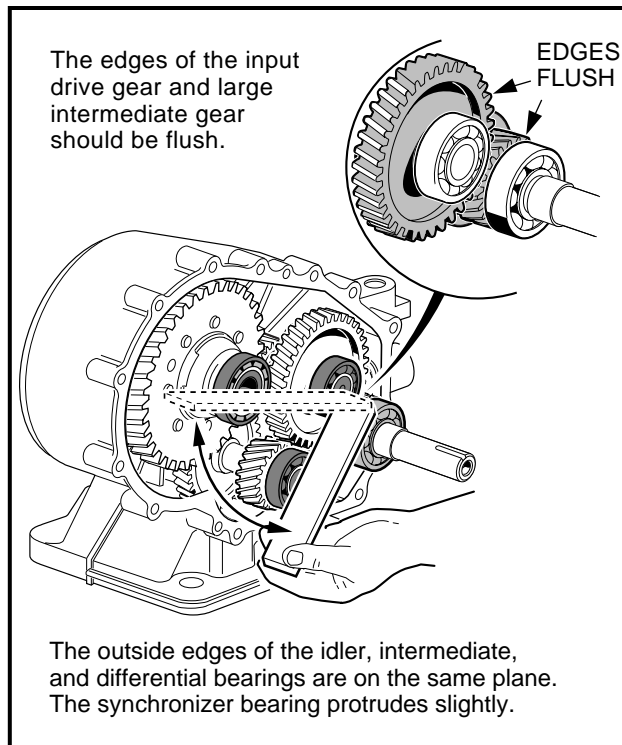


Figure 16-79 Gear Alignment

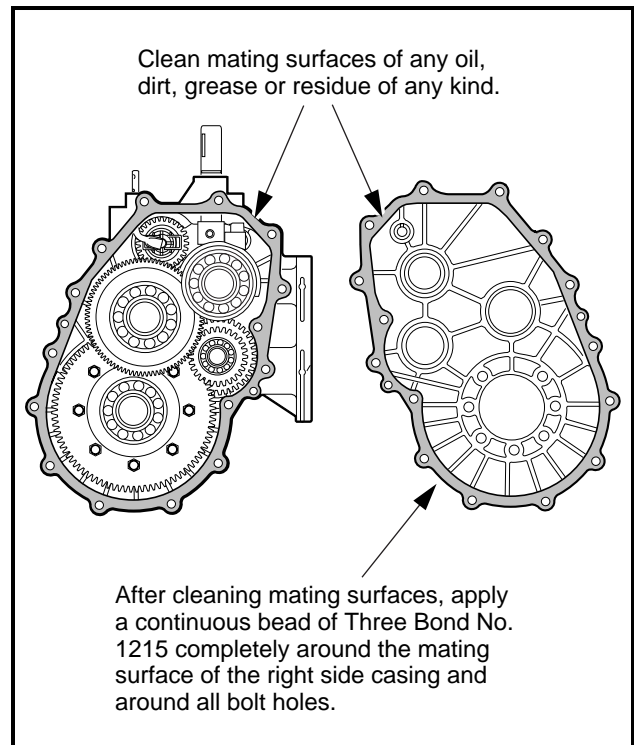


Figure 16-80 Prepare Mating Surfaces

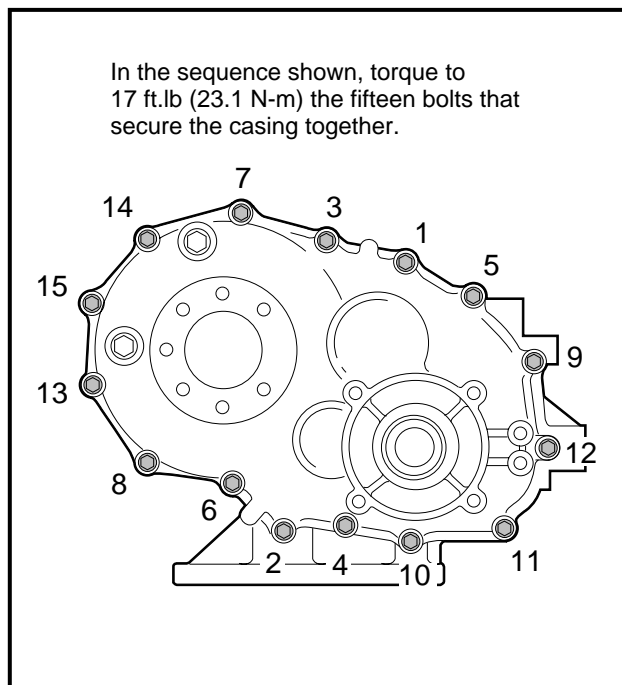


Figure 16-81 Casing Torque Sequence

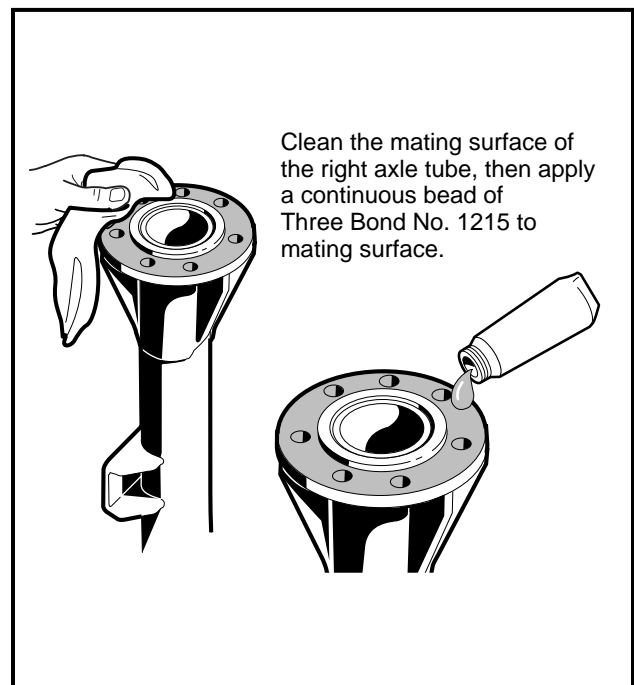
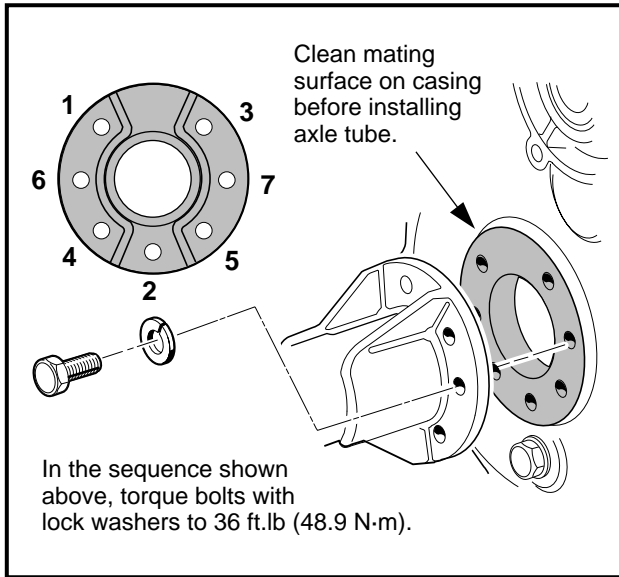
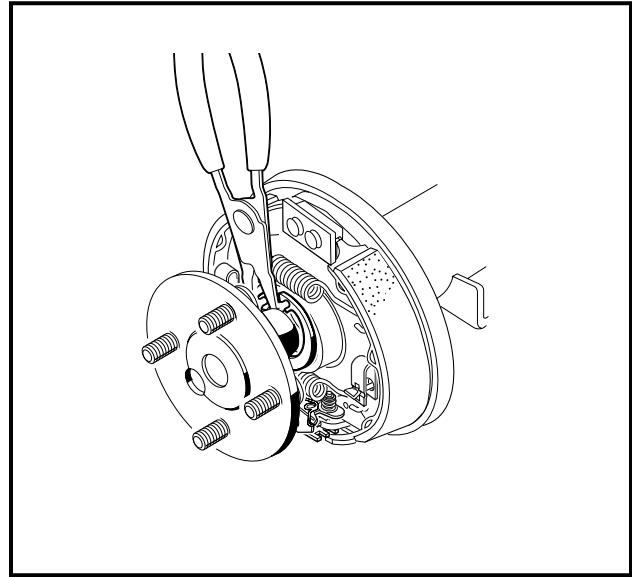


Figure 16-82 Axle Tube Surface

Unitized Transaxle Assembly, Continued:**Figure 16-83 Install Axle Tubes****Figure 16-84 Retaining Ring****UNITIZED TRANSAXLE INSTALLATION****Read DANGER and WARNING on page 16-1.**

1. Install the wheels. **See Section 8 – Wheels and Tires in the appropriate maintenance and service manual.**
2. Install the leaf springs. **See Section 9 – Rear Suspension in the appropriate maintenance and service Manual.**
3. Position the transaxle mounting plate on the two mounting studs at the rear of the engine, and then install the two mounting nuts (**Figure 16-85, Page 16-35**).
4. Install the remaining four mounting bolts and four nuts (one bolt and nut at each corner of the mounting plate).
5. Tighten the four corner nuts (with bolts) to 30 ft-lb (40.7 N·m). Tighten the two center nuts (on the studs) to 17 ft-lb (23.1 N·m).
6. Install the accelerator cable bracket on transaxle case. Tighten the mounting screws to 134 in-lb (15.1 N·m) (**Figure 16-86, Page 16-35**).
7. Install the governor cable bracket on transaxle case. Tighten the mounting screws to 134 in-lb (15.1 N·m) (**Figure 16-87, Page 16-35**).
8. Install governor lever arm on governor shaft (**Figure 16-88, Page 16-35**). With the governor lever arm loose on the governor shaft, turn the governor arm shaft counterclockwise until it stops. Then pull the governor lever arm rearward until the carburetor throttle is in the “wide open throttle” (WOT) position (**Figure 16-88, Page 16-35**).
9. While holding the arm and shaft in the fully counterclockwise position, tighten the governor arm lever nut to 35 in-lb (4.0 N·m).
10. Install the key onto the input shaft (**Figure 16-89, Page 16-36**).
11. Position the driven clutch on the transaxle input shaft and install the washer (yellow side facing out) and mounting bolt. Tighten the mounting bolt to 14 ft-lb (19.0 N·m) (**Figure 16-89, Page 16-36**).
12. Install the drive belt. **See Section 17 – Torque Converter.**

13. Remove the blocks from under the engine and roll the powertrain into position under the vehicle. Then lift the front of the powertrain and place the snubber into the snubber bracket in the vehicle frame (**Figure 16-90, Page 16-36**).
14. Position the floor jack under the rear frame crossmember and raise the jack high enough to support the vehicle. Make sure the vehicle is stable on the jack, then remove the jack stands.
15. After the jack stands are removed, lower the vehicle to approximately its normal height. Position the leaf springs in the front spring mounts and install the bolts and locknuts. Tighten to 15 ft-lb (20.3 N·m) (**Figure 16-91, Page 16-36**).
16. Using the floor jack, adjust vehicle height to position the leaf springs for mounting in the shackles. Install the mounting bolts, and locknuts (**Figure 16-92, Page 16-36**).
17. Position shocks in the shock mounts and install cushions, mounting washers and nuts (**Figure 16-93, Page 16-37**). Tighten nuts until cushions expand to be the same diameter as the mounting washers.
18. Connect brake cables. **See Section 6 – Wheel Brake Assemblies in the appropriate maintenance and service manual.**

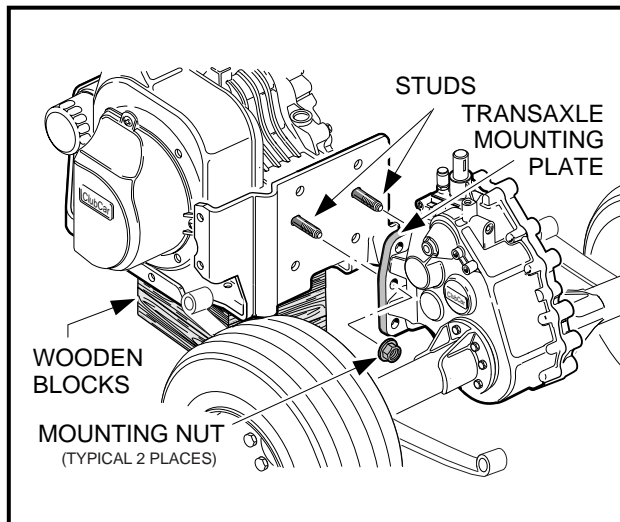


Figure 16-85 Transaxle Mounting

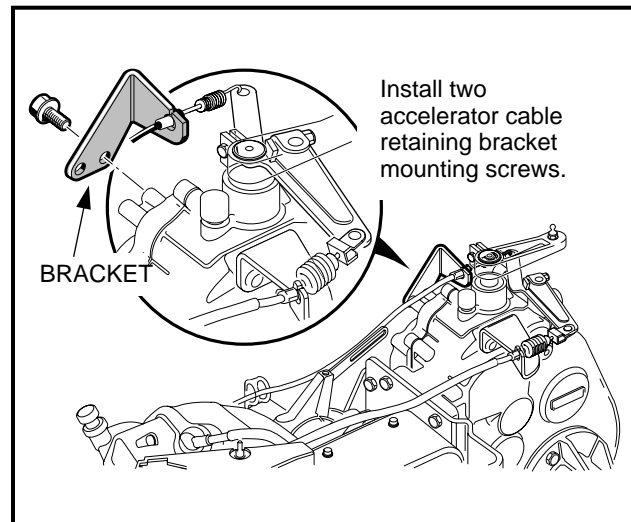


Figure 16-86 Accelerator Cable Bracket

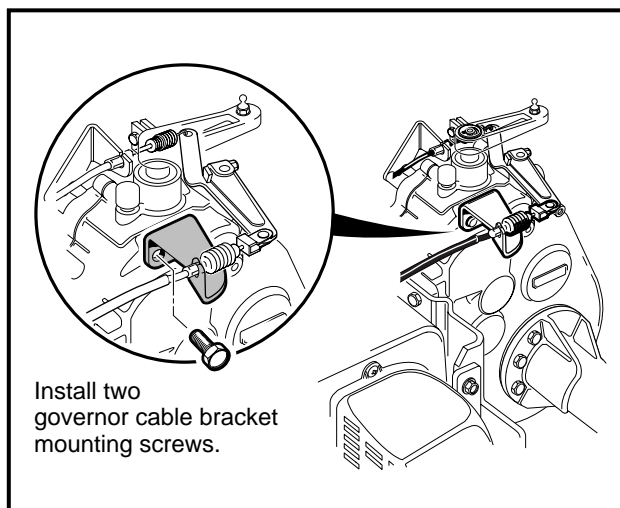


Figure 16-87 Governor Cable Bracket

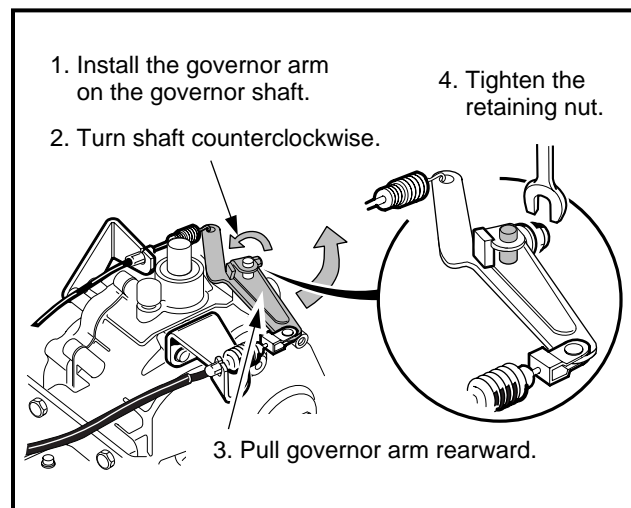
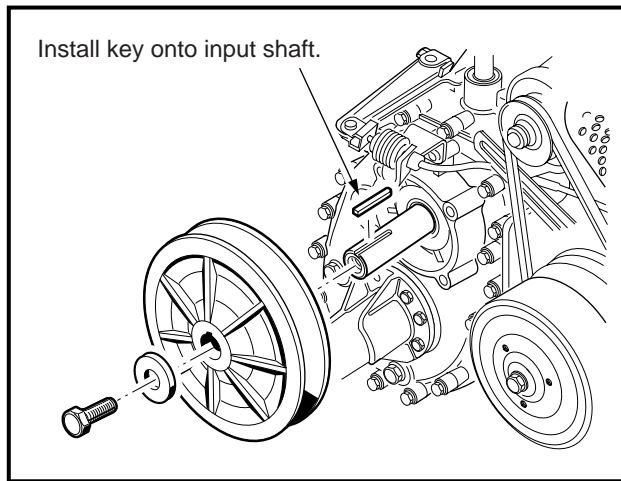
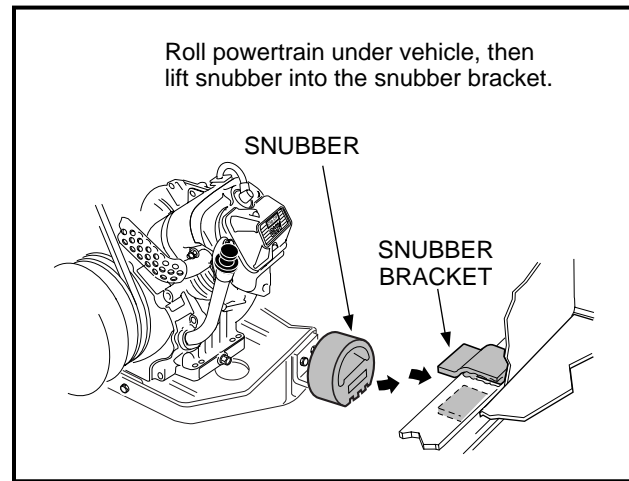
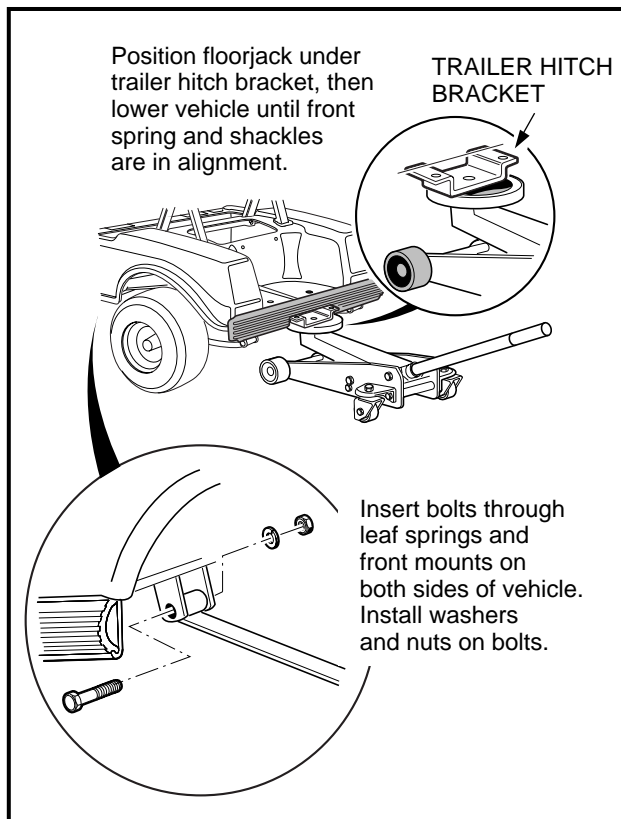
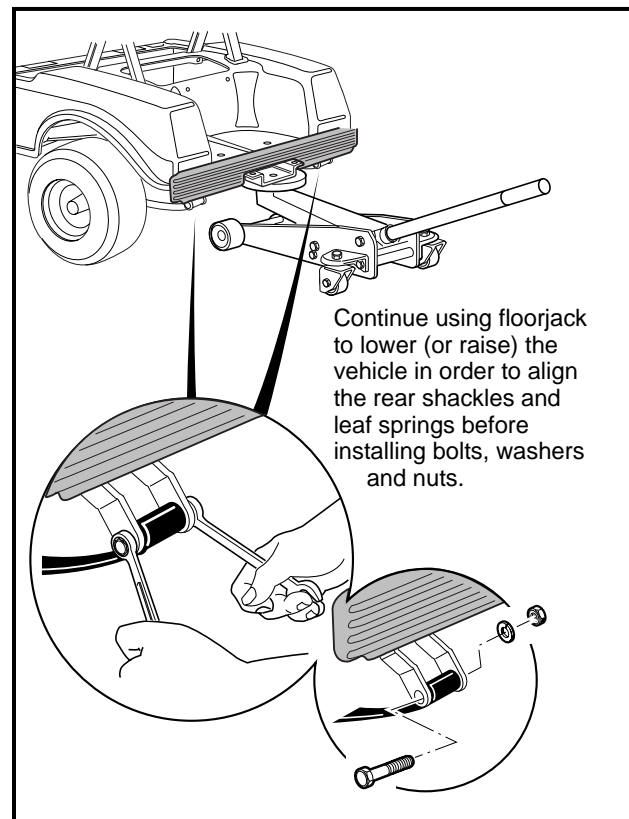


Figure 16-88 Governor Arm

Unitized Transaxle Installation, Continued:**Figure 16-89 Driven Clutch****Figure 16-90 Snubber****Figure 16-91 Leaf Springs****Figure 16-92 Leaf Springs and Shackles**

19. Connect the engine kill switch wire (18 gauge white/black stripe) to the bullet connector at the lower right front of the engine (**Figure 16-94, Page 16-37**).
20. Connect the oil level sensor wire (18 gauge yellow) to the jumper wire (**Figure 16-95, Page 16-37**).
21. Connect the 6 gauge white wire to the F2 post, the 6 gauge black ground wire to the A2 post and tighten to 48 in-lb (5.4 N·m). Connect the 16 gauge yellow wire to the DF post on the starter/generator and tighten to 30 in-lb (3.4 N·m) (**Figure 16-96, Page 16-37**).

22. Position the shifter cable in the shifter cable mounting bracket on the transaxle and tighten the mounting nuts to 22 ft-lb (29.8 N·m). Connect shifter cable rod end to the shifter arm (**Figure 16-97, Page 16-38**).
23. Attach the ground wire to the mounting screw on the oil filler tube mounting bracket and tighten to 50 in-lb (5.7 N·m) (**Figure 16-98, Page 16-38**).
24. Connect accelerator cable to actuator cam in the electrical box. Position the accelerator cable in mounting slot in the wall of the electrical box and tighten mounting nuts to 18 in-lb (2.0 N·m) (**Figure 16-100, Page 16-38**). Install electrical box cover and tighten mounting screw.
25. Pull fuel line from impulse line fitting of the fuel pump, connect it to the carburetor and secure with a hose clamp (**Figure 16-100, Page 16-38**).
26. Connect the impulse line to the fuel pump and secure it with the hose clamp (**Figure 16-101, Page 16-39**).
27. Connect air intake hose to carburetor and secure hose clamp (**Figure 16-102, Page 16-39**).
28. Connect carburetor vent tube to carburetor and secure with hose clamp (**Figure 16-103, Page 16-39**).
29. Install transaxle drain plug and tighten to 21 ft-lb (28.5 N·m).
30. Fill transaxle with 27 oz. (.8 liter) 80-90 Wt. API Class GL-3 or 80-90 Wt. AGMA Class EP gear lube. Install and tighten the level indicator hole plug to 21 ft. lb (28.5 N·m).

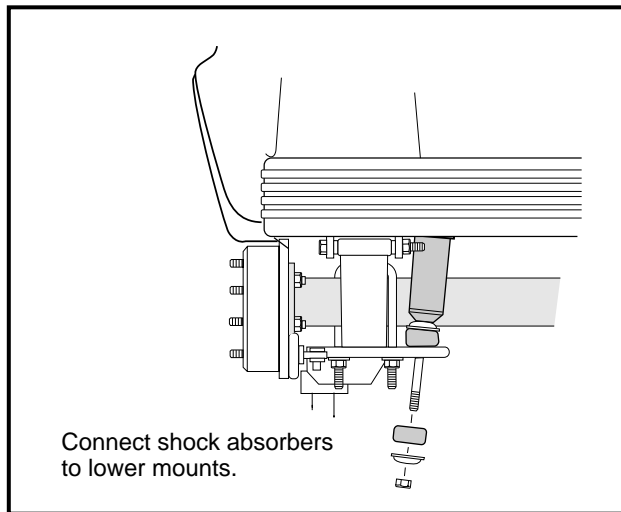


Figure 16-93 Shock Absorber

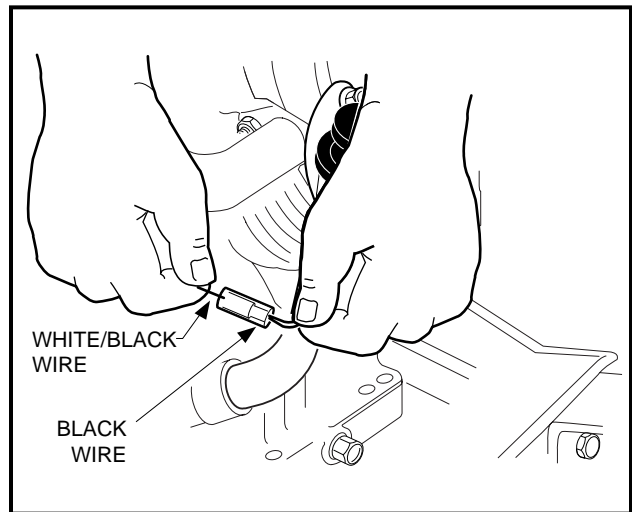


Figure 16-94 Ignition Kill Wire

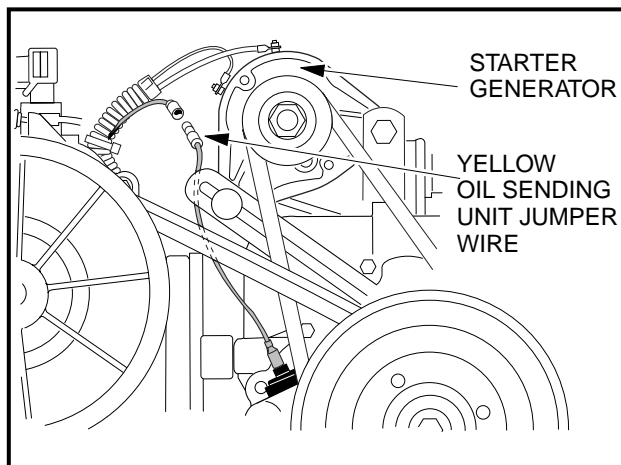


Figure 16-95 Oil Level Sensor Jumper wire

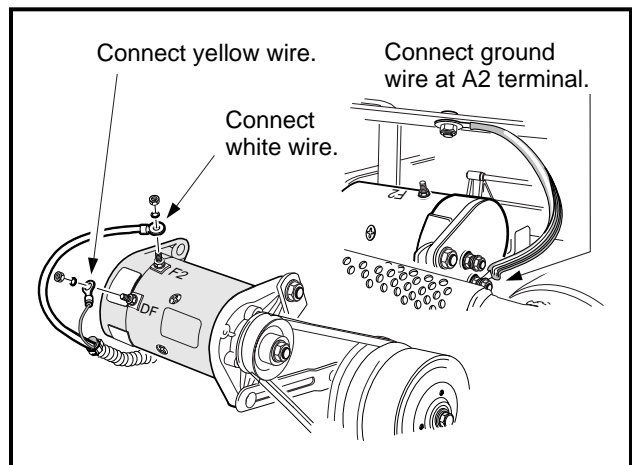


Figure 16-96 Starter/Generator

Unitized Transaxle Installation, Continued:

31. Check that all wiring is secured properly. **See following WARNING.**

⚠ WARNING

- IF WIRES ARE REMOVED OR REPLACED MAKE SURE WIRING AND WIRING HARNESS IS PROPERLY ROUTED AND SECURED TO VEHICLE FRAME. FAILURE TO PROPERLY ROUTE AND SECURE WIRING COULD RESULT IN VEHICLE MALFUNCTION, PROPERTY DAMAGE OR PERSONAL INJURY.

32. Connect the spark plug wire.
33. Connect the battery cables, positive cable first and tighten to 20 ft-lb (27.1 N·m).
34. Adjust the engine RPM setting. **See Engine RPM Adjustment, Section 14 – Fuel System, Page 14-14.**

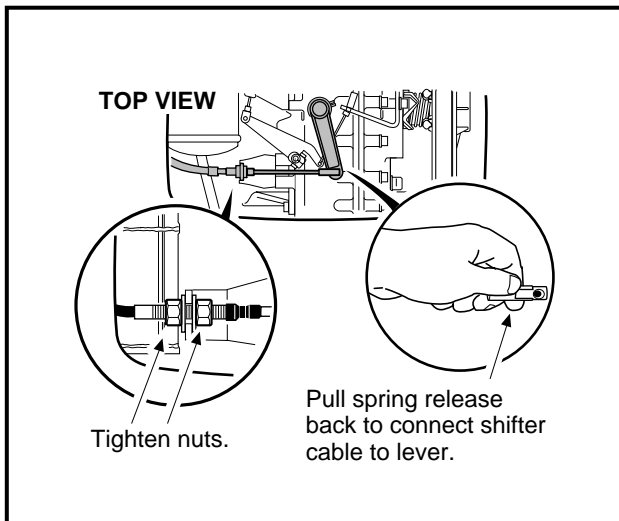


Figure 16-97 Connect Shifter Cable

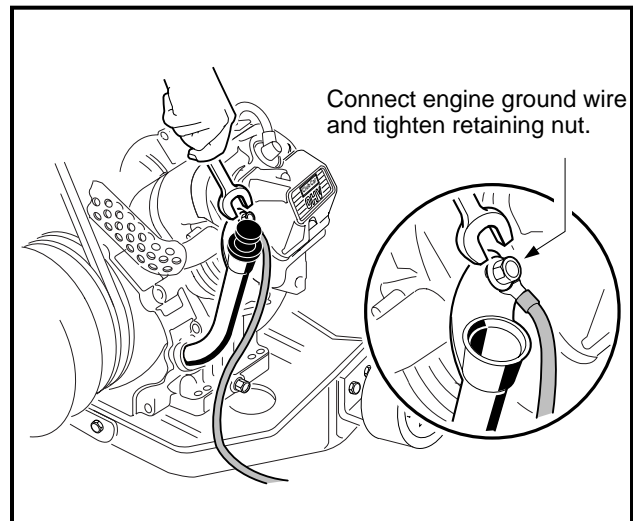


Figure 16-98 Engine Ground Wire

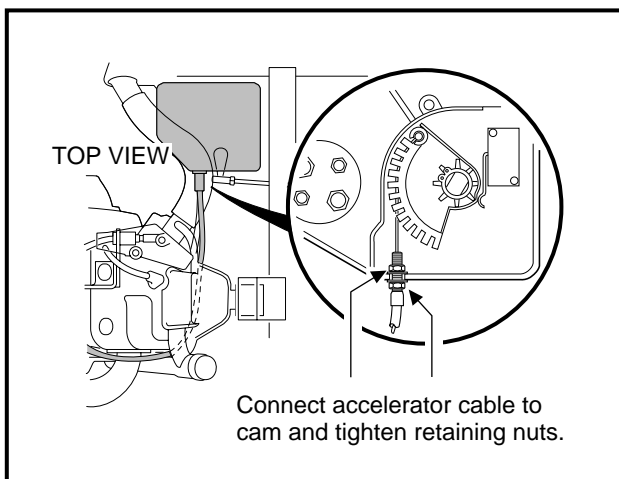


Figure 16-99 Connect Cable to Cam

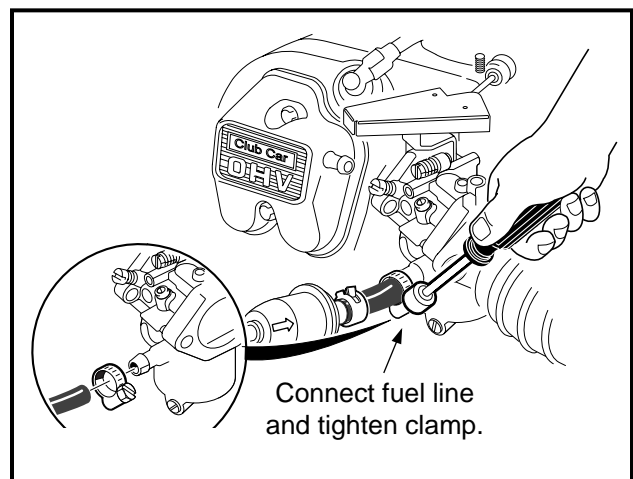


Figure 16-100 Connect Fuel Line

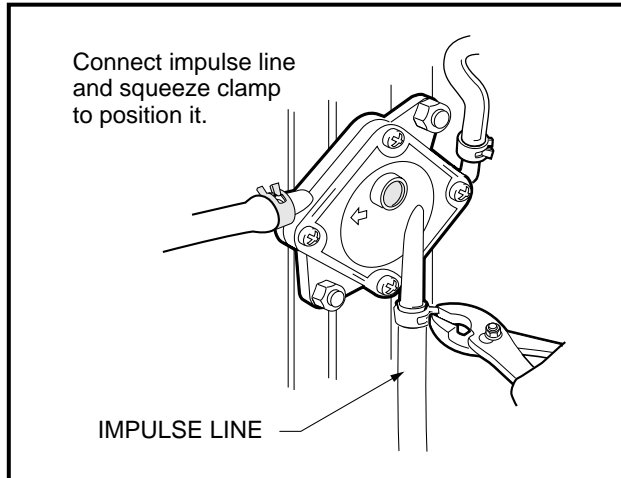


Figure 16-101 Impulse Line

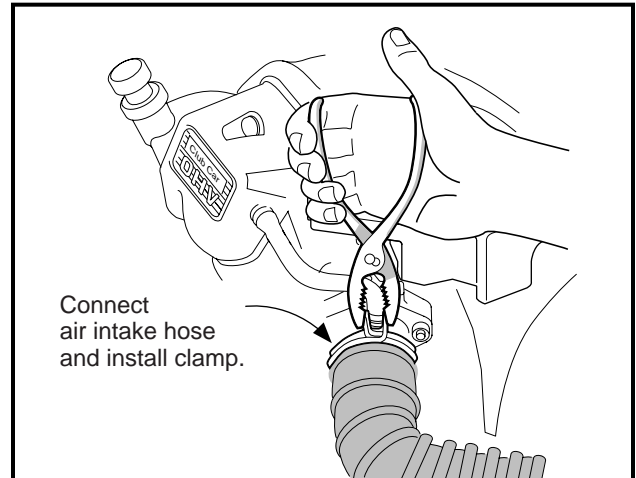


Figure 16-102 Air Intake Hose

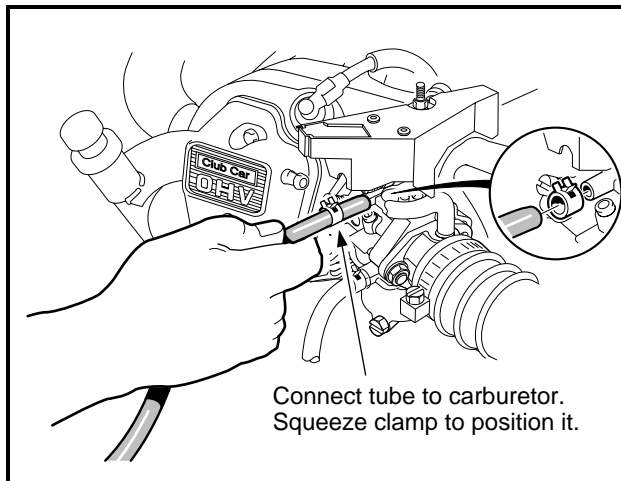


Figure 16-103 Carburetor Tube

FORWARD/REVERSE (F&R) SHIFTER CABLE

Read **DANGER** and **WARNING** on page 16-1.

If the F&R shifter cable is damaged in any way, it must be replaced.

F&R SHIFTER CABLE REMOVAL

NOTE

- BEFORE REMOVING CABLE, NOTE CABLE ROUTING AND POSITIONS OF WIRE TIES OR OTHER DEVICES SECURING THE CABLE TO THE VEHICLE. WHEN REINSTALLED, CABLE MUST BE ROUTED AND SECURED AS IT WAS ORIGINALLY.

1. Remove the ball joint socket (2) from the F&R shifter assembly ball stud (3) (**Figure 16-106, Page 16-41**).
2. Remove the ball joint socket (10) from the shifter arm ball stud (11) on the transaxle (**Figure 16-106, Page 16-41**).

F&R Shifter Cable Removal, Continued:

3. Loosen the retaining nuts (5) on both ends of the cable and remove the wire tie (**Figure 16-106, Page 16-41**).
4. Remove cable from the vehicle.

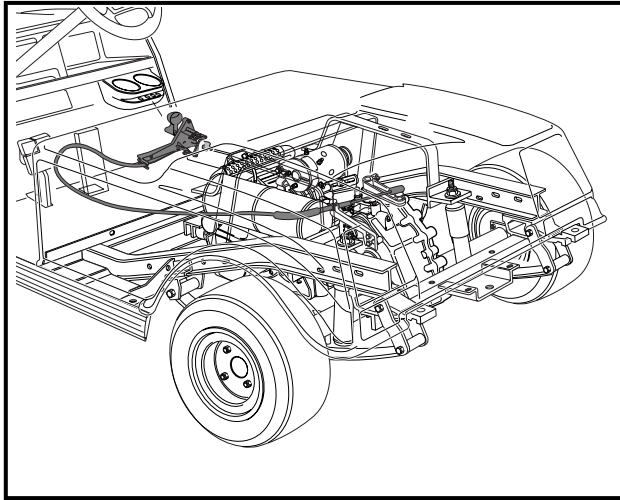


Figure 16-104 F&R Cable Routing

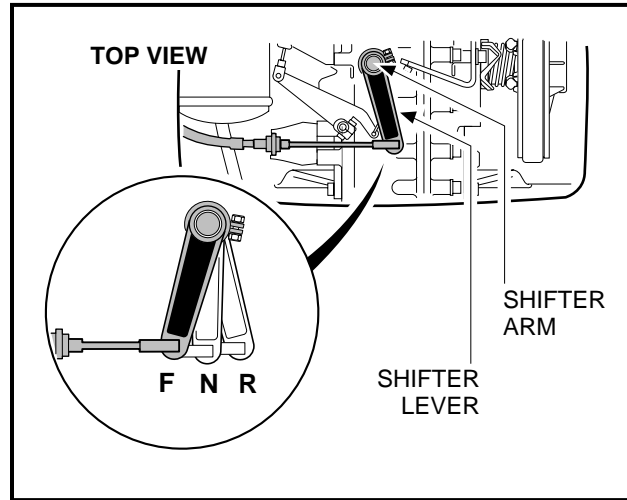


Figure 16-105 F&R Positions

F&R SHIFTER CABLE INSTALLATION

1. From the F&R shifter, route the cable toward the driver side of the vehicle so it lies against the side of the front body, turns 90° and passes to the driver side of air intake box, over the battery, beside the fender and then turns again to connect with the shifter arm on the transaxle (**Figure 16-104, Page 16-40**). Make sure cable does not touch muffler.
2. Secure the cable with a retaining nut (5) on each side of the shifter cable support bracket at the transaxle (**Figure 16-106, Page 16-41**). Tighten nuts to 22 ft-lb (29.8 N·m).
3. Secure the cable with a retaining nut (5) on each side of the shifter cable support bracket at the F&R assembly (**Figure 16-106, Page 16-41**). Tighten nuts to 22 ft-lb (29.8 N·m).
4. Install the ball joint socket (10) on the shifter lever ball stud (11) on the transaxle (**Figure 16-106, Page 16-41**).
5. Install the ball joint socket (2) on the F&R shifter assembly ball stud (3) (**Figure 16-106, Page 16-41**).
6. Attach F&R cable at cable retainer (7).
7. Install wire tie (8) to secure wire harness to cable at the support bracket near the F&R shifter assembly (**Figure 16-106, Page 16-41**). See following **WARNING**.

⚠ WARNING

- IF WIRES ARE REMOVED OR REPLACED, MAKE SURE WIRING AND WIRING HARNESS IS PROPERLY ROUTED AND SECURED TO VEHICLE FRAME. FAILURE TO PROPERLY ROUTE AND SECURE WIRING COULD RESULT IN VEHICLE MALFUNCTION, PROPERTY DAMAGE OR PERSONAL INJURY.

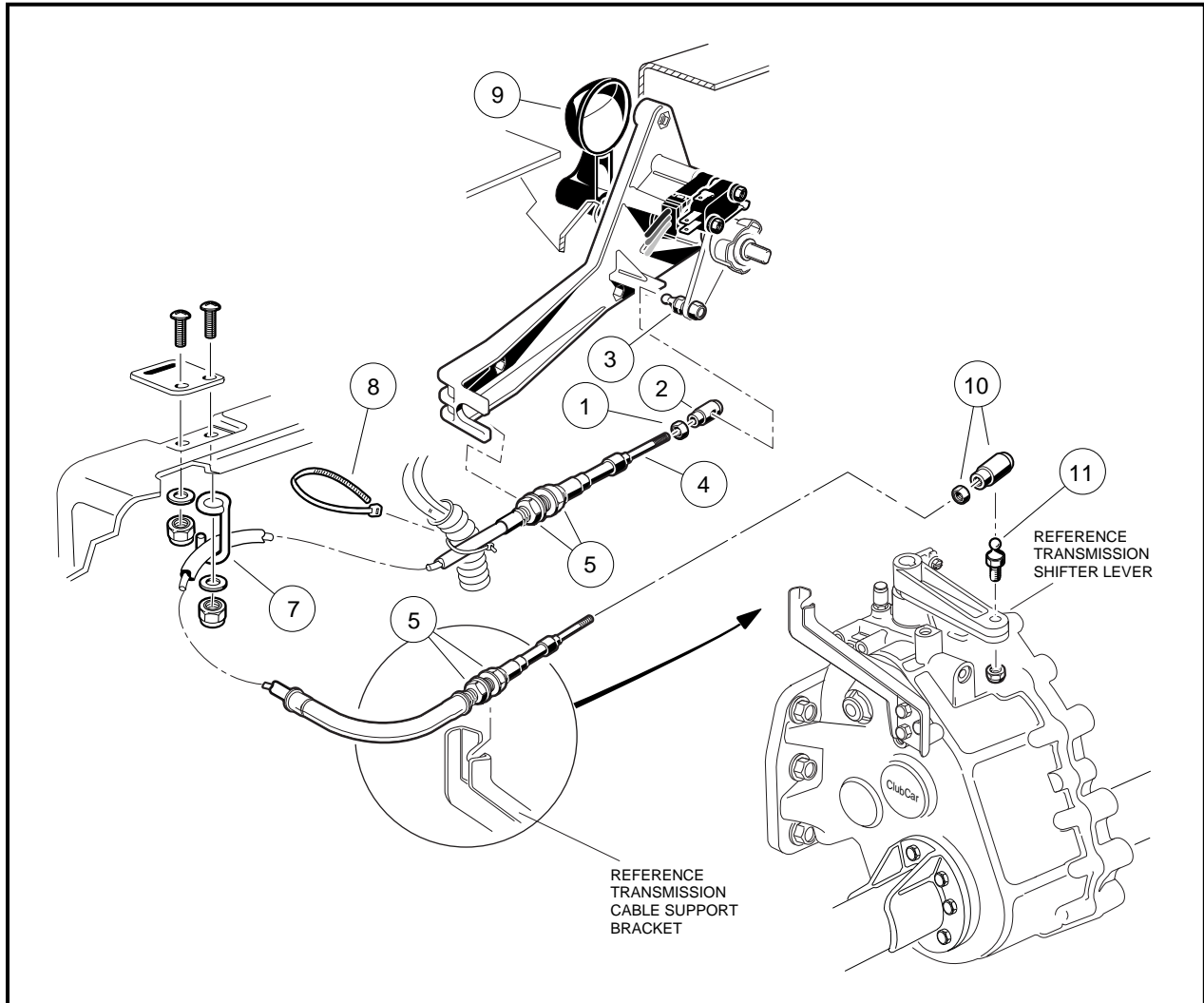


Figure 16-106 F&R Shifter Cable

F&R SHIFTER CABLE ADJUSTMENT

With the shifter lever of the unitized transaxle in the NEUTRAL position (**Figure 16-106, Page 16-41**), the Forward/Reverse handle (21) should be straight up. For minor adjustments, the nut (1) may be loosened and the ball joint socket (2) rotated to get the proper adjustment (**Figure 16-106, Page 16-41**). **See following CAUTION.**

⚠ CAUTION

- BE SURE THREADS OF CABLE ARE ENGAGED IN BALL JOINT SOCKET AT LEAST 1/4 INCH (6.35 MM). IF BALL JOINT SOCKET COMES LOOSE FROM THE CABLE, THE F&R SHIFTER WILL NOT OPERATE PROPERLY.

For major adjustments, the cable retaining nuts (5) must be loosened and adjusted. When the cable is properly adjusted, with the Forward/Reverse handle (9) (**Figure 16-106, Page 16-41**) in the NEUTRAL position, the shift lever of the transaxle will also be in the NEUTRAL position (**Figure 16-105, Page 16-40**). Retighten nuts to 22 ft-lb (29.8 N·m).

SECTION 17 – TORQUE CONVERTER

DANGER

- **GASOLINE – FLAMMABLE! EXPLOSIVE! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM VEHICLE AND SERVICE AREA. SERVICE ONLY IN A WELL-VENTILATED AREA.**
- **DO NOT OPERATE VEHICLE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. THE ENGINE PRODUCES CARBON MONOXIDE, WHICH IS AN ODORLESS, DEADLY POISON.**

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR. FOLLOW ALL PROCEDURES EXACTLY AND HEED ALL WARNINGS STATED IN THIS MANUAL.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERY.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- HOT! DO NOT ATTEMPT TO SERVICE HOT ENGINE OR EXHAUST SYSTEM. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE BURNS.
- FRAME GROUND – DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRIC WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR ANY OTHER METAL COMPONENT.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (–) FIRST.
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- FOR VEHICLES WITH CARGO BEDS, REMOVE ALL CARGO BEFORE RAISING THE BED. DO NOT CLOSE BED UNTIL ALL PERSONS ARE CLEAR OF CARGO BED AREA. KEEP HANDS CLEAR OF CRUSH AREA BETWEEN BED AND SEAT BACK SUPPORT. DO NOT DROP CARGO BED; LOWER GENTLY AND KEEP ENTIRE BODY CLEAR. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SEVERE PERSONAL INJURY.

GENERAL INFORMATION

The torque converter consists of a drive clutch, a driven clutch, and a drive belt. The drive clutch, which is mounted to the engine, is in the open position when the engine is at idle. At this point, the belt is riding at a low position (smaller diameter) on the drive clutch. The driven clutch is mounted on the transaxle. It is in the closed position, and the drive belt is riding at a high position (large diameter) on it when the engine is at idle.

At the point of clutch engagement, the speed ratio of the drive clutch to the driven clutch is 3.5 to 1. This ratio provides excellent starting and low-speed torque.

As engine speed increases, centrifugal force on internal weights close the drive clutch, pushing the belt up to a higher position on the clutch (increasing the diameter of the belt loop). As the diameter of the belt loop increases at the drive clutch, the driven clutch is forced open as the diameter of its belt loop decreases. At governed top speed, the ratio of drive clutch to driven clutch is .92 to 1.

On steep grades, or when the vehicle is heavily loaded, higher torques are achieved through the use of a torque-sensing ramp device on the driven clutch. This device overcomes the force of the centrifugal weights to close the driven clutch and open the drive clutch, thus increasing axle torque with little or no change in engine RPM.

The engine and torque converter rotate clockwise as viewed from the clutch side of the engine.

To provide optimum performance for the OHV engine and powertrain, the vehicle uses a pair of tuned clutches.

To properly assemble and disassemble the torque converter, the following tools should be used:

- Torque Converter Tool Kit, Club Car Part No. 1014510 (**Figure 17-1, Page 17-2**).
- Scribe or small pick (not included in torque converter tool kit).

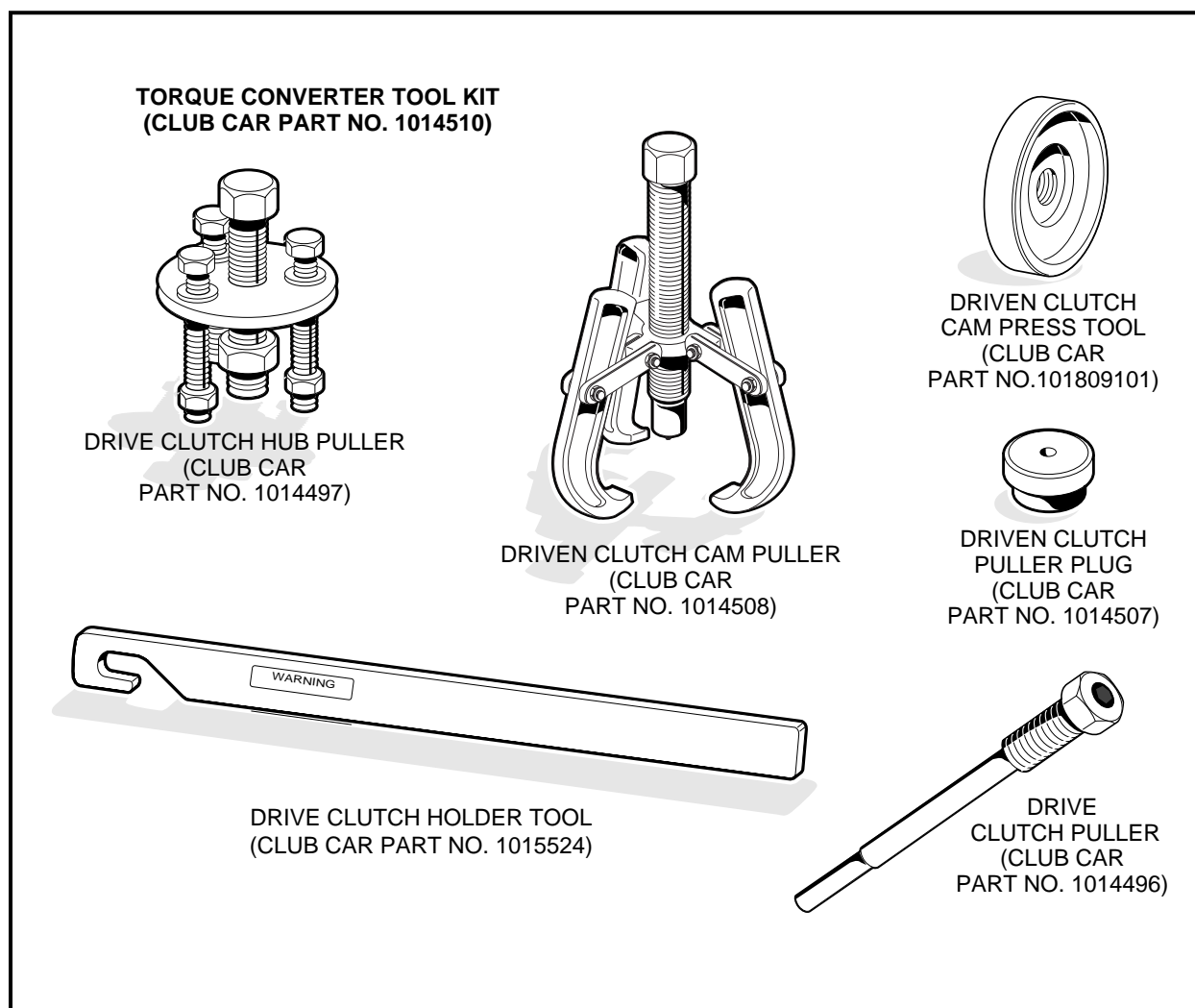


Figure 17-1 Torque Converter Tool Kit

TROUBLESHOOTING

Read DANGER and WARNING on page 17-1.

Maintaining proper adjustment of the engine and governor, as well as the torque converter, is essential to the troubleshooting process. If these adjustments are within Club Car specifications and, when climbing a steep hill, the engine begins to lose RPM before the drive belt reaches the top of the driven clutch, there is a torque converter problem.

If the torque converter is not operating properly:

1. Check the governor and throttle settings. **See Section 14 – Fuel System.**
2. Inspect the driven clutch for dirt and dust buildup on its component parts. Clean the driven clutch with water to remove any dust or dirt, then drive the vehicle and check for proper operation.
3. If cleaning the driven clutch does not solve the problem, disassemble and thoroughly clean all parts of the drive clutch. Be sure to clean the plastic drive buttons (10) (**Figure 17-5, Page 17-6**).

DRIVE BELT

Read DANGER and WARNING on page 17-1.

The drive belt should be inspected semiannually for wear and (or) glazing. If it is excessively worn, frayed, or glazed, replace the belt.

As the drive belt wears, the engine RPM will increase to compensate for the change in torque converter ratio. This will keep the vehicle's maximum ground speed correct. **See Section 2 – Vehicle Specifications in the appropriate maintenance and service manual for appropriate maximum ground speed.**

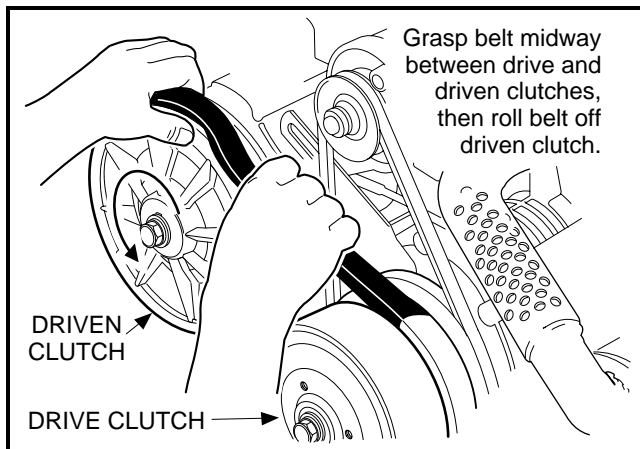


Figure 17-2 Drive Belt Removal

DRIVE BELT REMOVAL

1. Place the Forward/Reverse handle in the NEUTRAL position, chock the wheels and disconnect the battery, negative (–) cable first. Disconnect the spark plug wire from the spark plug.
2. Grasp the belt midway between the drive and driven clutches. Lift upward on the belt to force the sheaves of the DRIVEN clutch apart, then roll the belt off the DRIVEN clutch by rotating the clutch counterclockwise (**Figure 17-2, Page 17-3**). **See following CAUTION.**

⚠ CAUTION

- MAKE SURE FINGERS ARE NOT UNDERNEATH THE BELT WHEN ROLLING THE BELT OFF THE DRIVEN CLUTCH.

3. Remove the belt from the drive clutch.

DRIVE BELT INSTALLATION

1. Position the new belt on the drive clutch, then start the belt over the top of the driven clutch.
2. With the belt started onto the driven clutch, rotate the driven clutch counterclockwise and roll the belt over the driven clutch sheaves and onto the clutch.

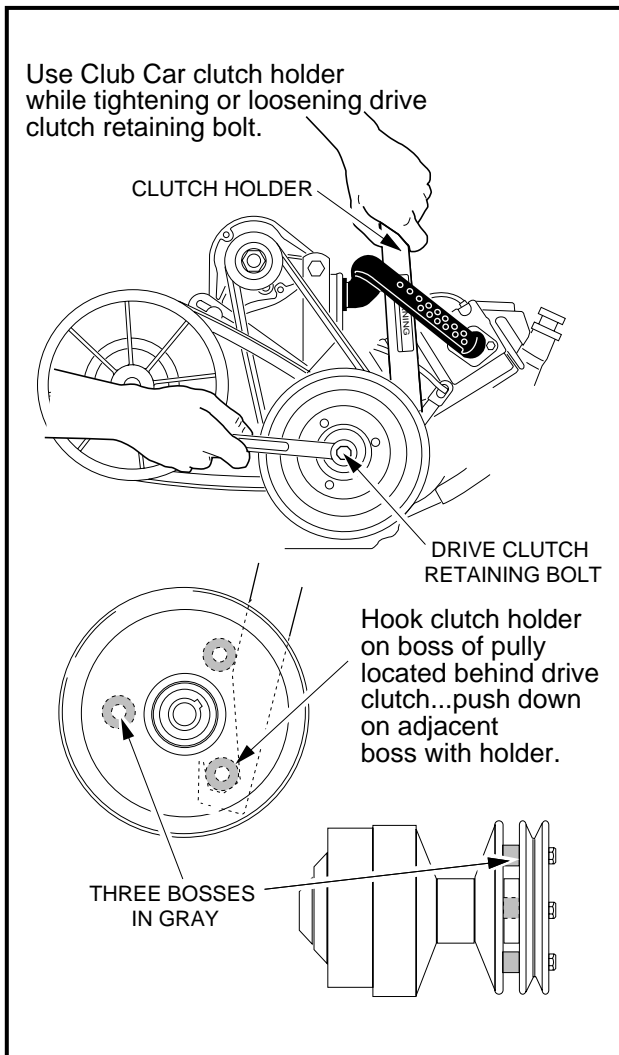


Figure 17-3 Loosen Retaining Bolt

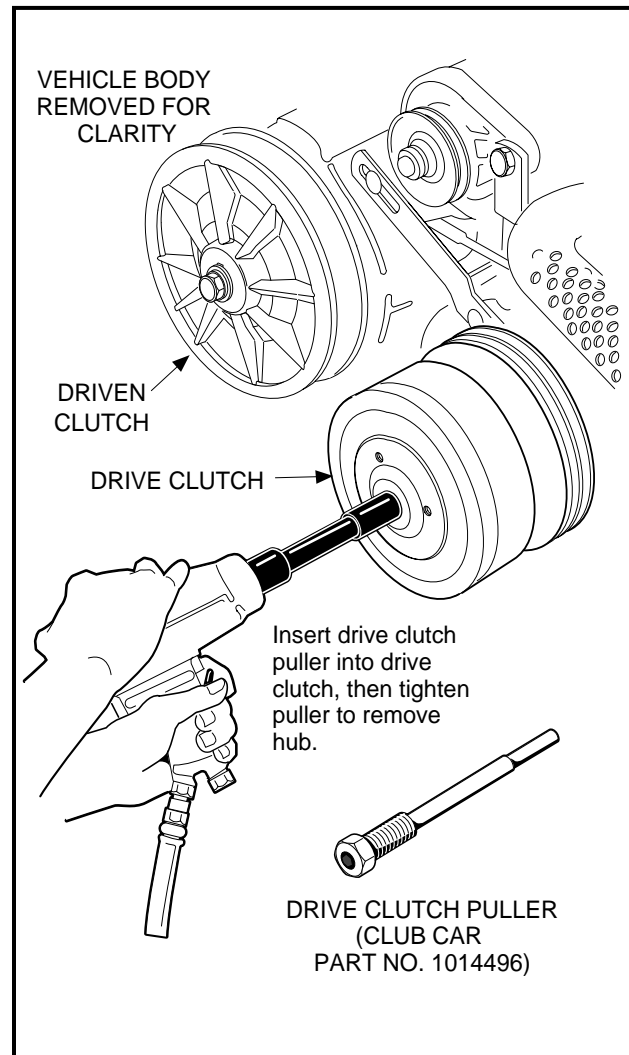


Figure 17-4 Drive Clutch Removal

DRIVE CLUTCH

Read **DANGER** and **WARNING** on page 17-1.

⚠ CAUTION

- BE VERY CAREFUL WHEN HANDLING THE CLUTCHES. A CLUTCH THAT HAS BEEN DROPPED WILL NOT BE PROPERLY BALANCED. IF EITHER CLUTCH IS DROPPED, ASSUME THAT IT IS DAMAGED AND REPLACE IT.

DRIVE CLUTCH REMOVAL

1. Remove the drive belt as instructed on page 17-3.
2. Loosen the starter/generator mounting and adjusting hardware and then remove the starter belt. **See WARNING on page 17-1.**
3. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Place jackstands under the axle tubes to support the vehicle. This will allow the weight of the centerline of the drive clutch to drop below the frame I-beam for access to the bolt securing the drive clutch. **See following WARNING.**

WARNING

- LIFT ONLY ONE END OF A VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES, UNLOAD THE CARGO BED, AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACK STANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.

4. Remove the drive clutch retaining bolt (17) and mounting washer (19) (**Figure 17-5, Page 17-6**) (**See also Figure 17-3**). **See following NOTE.**

NOTE

- THE DRIVE CLUTCH MOUNTING BOLT HAS LEFT-HAND THREADS.
- THE CRANKSHAFT HAS LEFT-HAND THREADS AT THE CLUTCH MOUNTING HOLE.

5. Lubricate the threaded portion of the clutch puller tool with a light oil and thread the clutch puller tool into the clutch retaining bolt hole.
6. Using a 1/2 inch drive air wrench, tighten the clutch puller tool. The drive clutch will come free of the crankshaft (**Figure 17-4, Page 17-4**).
7. Support the drive clutch assembly in your hand and back the clutch puller tool out of the crankshaft.

CAUTION

- DO NOT HIT OR TAP THE CLUTCH WITH A HAMMER. DO NOT PRY THE CLUTCH. THESE ACTIONS WILL DAMAGE THE CLUTCH.

DRIVE CLUTCH CLEANING AND INSPECTION

1. Use a dry, lint-free cloth to clean clutch parts.

CAUTION

- DO NOT LUBRICATE THE DRIVE CLUTCH. LUBRICANTS ATTRACT DIRT AND DUST, WHICH INTERFERE WITH PROPER CLUTCH OPERATION.
- USE ONLY A DRY CLOTH TO LIGHTLY WIPE THE SHAFT OF THE FIXED FACE ASSEMBLY (7) (**FIGURE 17-5, PAGE 17-6**). DO NOT USE A BRUSH OR STEEL WOOL. THESE WILL DAMAGE THE SURFACE OF THE SHAFT.
- DO NOT USE SOLVENTS. SOLVENTS WILL DAMAGE THE LUBRICATING CHARACTERISTICS OF THE BUSHINGS.

Drive Clutch Cleaning and Inspection, Continued:

2. Inspect the belt contact surfaces of the clutch sheaves for wear. If any area of a sheave contact surface has wear of 0.060 inch (1.52 mm) or more, the clutch should be replaced.

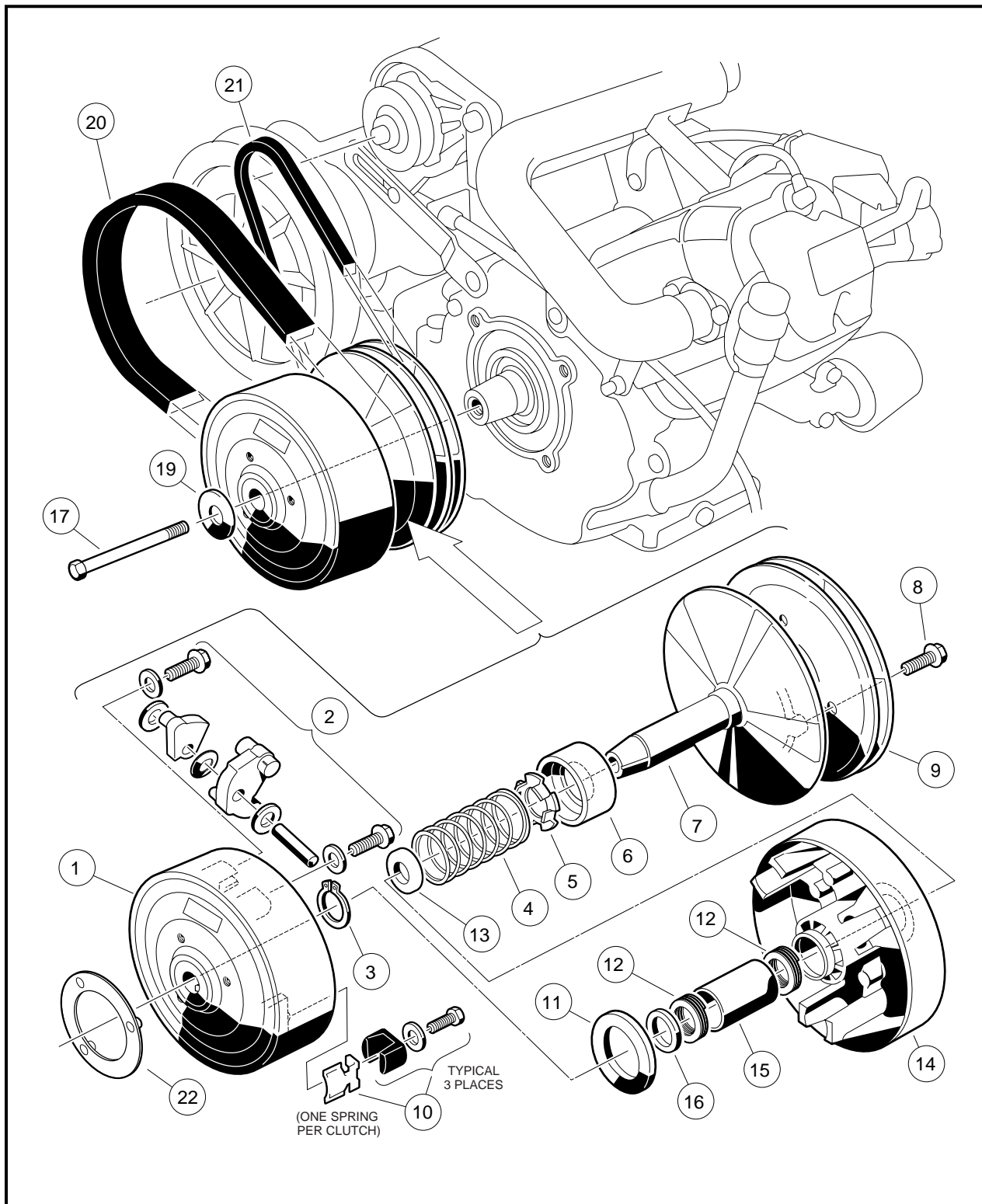


Figure 17-5 Drive Clutch Assembly

DRIVE CLUTCH DISASSEMBLY

⚠ CAUTION

- THE DRIVE CLUTCH IS BALANCED AS AN ASSEMBLY. BEFORE DISASSEMBLY, MAKE MATCH MARKS ON THE CLUTCH COVER AND ON THE MOVEABLE FACE ASSEMBLY SO THEY CAN BE REASSEMBLED IN THE SAME POSITIONS (**FIGURE 17-6, PAGE 17-7**).

1. Make match marks on the clutch cover and on the moveable face casting (**Figure 17-6, Page 17-7**).
2. Remove the clutch cover (1) (**Figure 17-5, Page 17-6**):
 - 2.1. Remove the clutch plug (22) (**Figure 17-5, Page 17-6**).
 - 2.2. Thread the center bolt of the Drive Clutch Hub Puller (Club Car Part No. 1014497) into clutch until the stop nut touches the clutch, then back the bolt out one-half turn (**Figure 17-7, Page 17-7**).
 - 2.3. Thread the three small bolts of the puller into corresponding holes in the clutch. Tighten bolts evenly, making sure the face of the puller plate is parallel to the face of clutch (**Figure 17-7, Page 17-7**).
 - 2.4. Unscrew the puller center bolt out of the clutch to pull clutch cover off.
3. Remove the thrust washer (11) from the moveable face (14) (**Figure 17-5, Page 17-6**).
4. Remove the drive buttons (**Figure 17-8, Page 17-8**).
 - 4.1. Remove the screws, flat washers, drive button take-up spring, and drive buttons as shown (**Figure 17-8, Page 17-8**).
5. Remove the clutch weights (**Figure 17-9, Page 17-8**):
 - 5.1. Remove the screws and flat washers attaching the weights as shown (**Figure 17-9, Page 17-8**).
 - 5.2. Pull the weight assemblies, with pins, from the clutch.
 - 5.3. Before removing, note the orientations of the wave washer and of the primary and secondary weights to one another (**Figures 17-12 and 17-13, page 17-10**). Remove the plastic washers, weights and wave washer from the pin. Retain all parts.

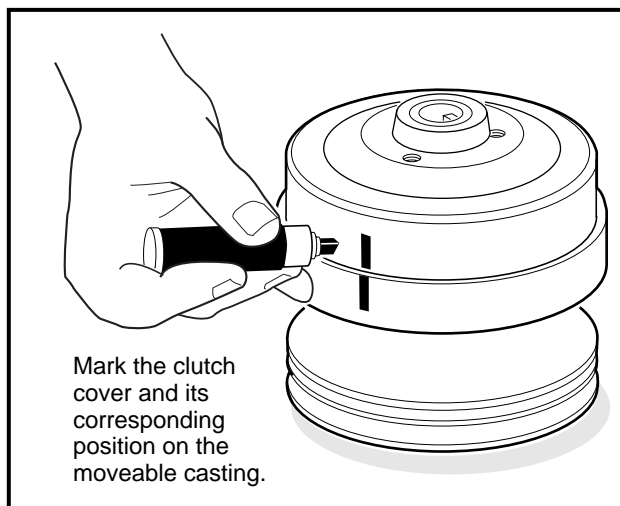


Figure 17-6 Mark Clutch Cover

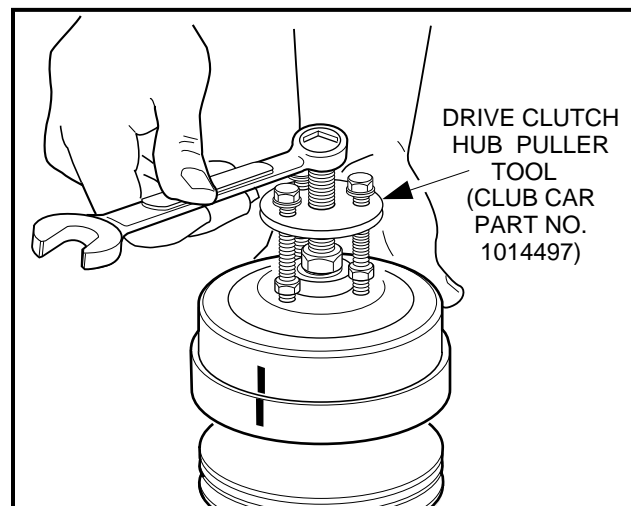
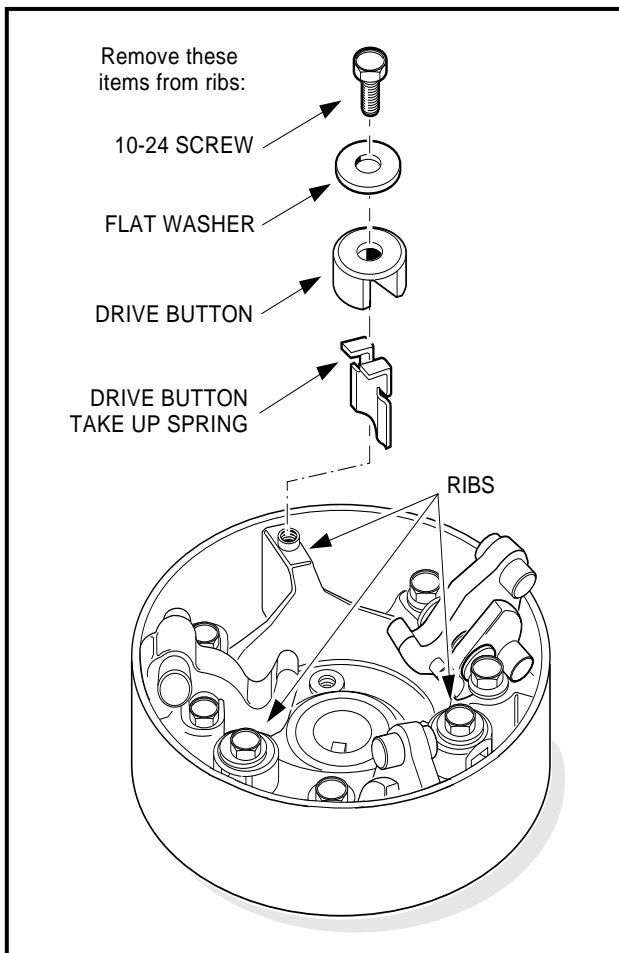
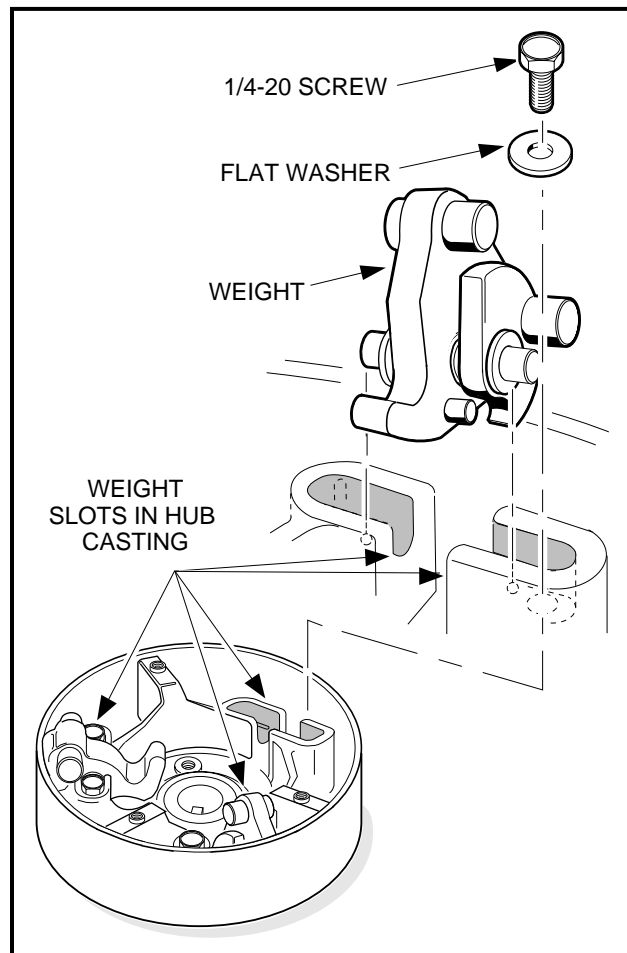


Figure 17-7 Remove Clutch Cover

6. Remove the retaining ring (3) from the shaft of the fixed face assembly (7) and slide the moveable face (14) off the shaft (**Figure 17-5, Page 17-6**). See following NOTE.

NOTE

- IF THE MOVEABLE FACE IS REMOVED FROM THE HUB OF THE FIXED FACE, THE SPIRAL BACK-UP RINGS (12) (**FIGURE 17-5, PAGE 17-6**) MUST BE REPLACED WITH NEW ONES.

Drive Clutch Disassembly, Continued:**Figure 17-8 Drive Button Mounting****Figure 17-9 Weight Position**

7. Remove the spacer (16), and spring (4) and retainer (5). The spring retainer can be removed from the spring if necessary (**Figure 17-5, Page 17-6**).
8. If necessary, remove idler bearing. Use a press to remove the bearing (**Figure 17-10, Page 17-9**). See following **NOTE**.

NOTE

- DO NOT REMOVE THE IDLER BEARING UNLESS IT NEEDS TO BE REPLACED. IF IDLER BEARING IS REMOVED, REPLACE IT WITH A NEW BEARING.

9. Use a scribe or small pick to remove the spiral backup rings (12) from each end of the bore in the fixed face assembly (**Figure 17-5, Page 17-6**). See **Figure 17-11, Page 17-9**. Discard the rings.

INSPECTION OF DRIVE CLUTCH PARTS

1. Inspect the idler bearing (6) for smooth rotation or seal damage (**Figure 17-5, Page 17-6**).

NOTE

- IT IS NORMAL FOR A SMALL AMOUNT OF GREASE TO BE PRESENT AT THE EDGE OF SEAL.

2. Inspect the bore of the moveable face assembly (14) for scarring or wear. The moveable face assembly must be replaced if the bore is worn to a diameter of 0.883 inch (22.4 mm) or larger (**Figure 17-5, Page 17-6**).
3. Inspect the steel shaft (7) on the fixed face assembly. There should be no measurable wear anywhere on the shaft. Replace the shaft if it is worn, scratched, or damaged (**Figure 17-5, Page 17-6**).
4. Inspect the thrust washer (11) for wear. If it is worn more than 0.030 inch (0.76 mm), turn it over or replace it with a new one (**Figure 17-5, Page 17-6**).
5. Inspect the primary weights (2) and the hub casting for wear. If the primary weights show signs they are touching the casting, the tips of the weights have worn beyond specification and they must be replaced (**Figure 17-5, Page 17-6**).
6. Inspect the pins on the primary weights (2). There should be no measurable wear. Replace them if they are worn, scratched, or damaged (**Figure 17-5, Page 17-6**).
7. Inspect the drive belt pulley sheaves for excessive wear or damage. If the sheaves are excessively worn or damaged, replace the entire fixed face drive assembly.

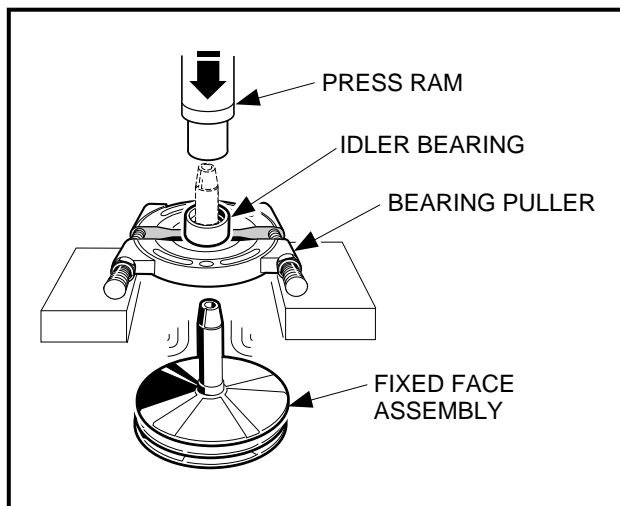


Figure 17-10 Remove Idler Bearing

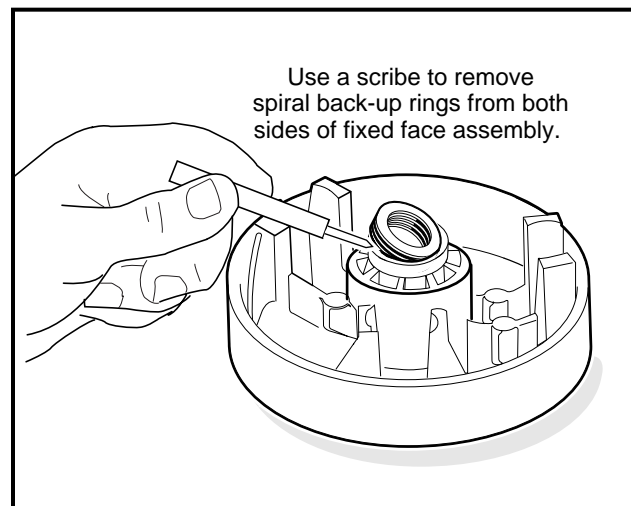


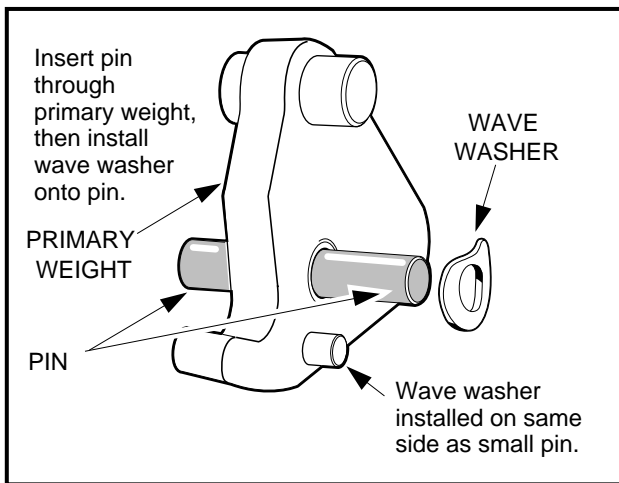
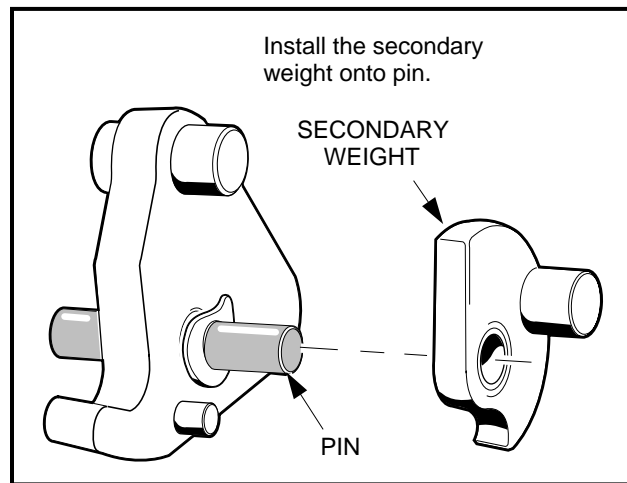
Figure 17-11 Spiral Back-up Rings

DRIVE CLUTCH ASSEMBLY

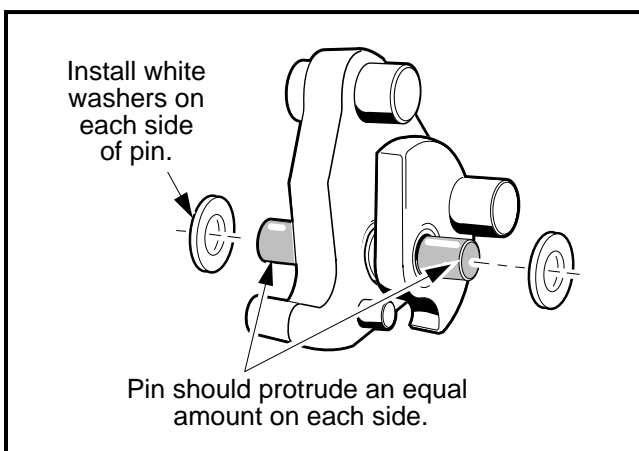
1. Press idler bearing (6) onto the shaft of the fixed face assembly (7). Press on the inner race of the bearing only. Make sure that the cup side of bearing is facing away from the fixed face (**Figure 17-5, Page 17-6**).
2. Using needle nose pliers, install the spring retainer (5) onto the spring (4) (**Figure 17-5, Page 17-6**).
3. Install the spring (4) and retainer (5) into the cup of the idler bearing (6) (**Figure 17-5, Page 17-6**).
4. Install the spacer (13) onto the shaft of the fixed face (**Figure 17-5, Page 17-6**).
5. Install a new spiral backup ring (12) in each end of the bore of the moveable face assembly (14) (**Figure 17-5, Page 17-6**).
6. Install the moveable face assembly (14) onto the shaft of the fixed face assembly (7) (**Figure 17-5, Page 17-6**).

⚠ CAUTION

- TO AVOID DAMAGING THE SPIRAL BACK-UP RINGS, BE VERY CAREFUL WHEN INSTALLING THE MOVEABLE FACE.

Drive Clutch Assembly, Continued:**Figure 17-12 Install Pin and Washer****Figure 17-13 Install Secondary Weight**

- 6.1. Rotate the moveable face assembly clockwise while installing it onto the shaft.
- 6.2. Install the retaining ring (3) (**Figure 17-5, Page 17-6**).
7. Install the primary weights on the mounting pins (**Figure 17-12, Page 17-10**).
8. Install a wave washer on each mounting pin. Make sure that the concave side of the washer faces the side of the primary weight with the small guide pin protruding from it (**Figure 17-12, Page 17-10**).
9. Install the secondary weights onto the mounting pins with the weight pins on the secondary weights pointing away from the primary weights. The wave washers should be between the primary and secondary weights (**Figure 17-13, Page 17-10**).
10. Install white plastic flat washers on each end of the mounting pin and push them against the outside surfaces of the weights. Center the weights and washers on the mounting pin (**Figure 17-14, Page 17-10**).
11. Install the weight assemblies into the slots in the hub casting (**Figure 17-9, Page 17-8**). Make sure the mounting pin protrudes an equal amount on each side of the weights when the assemblies are in position (**Figure 17-14, Page 17-10**).

**Figure 17-14 Install White Washers**

12. Install the 1/4-20 screws and washers (2) and tighten them to 10 ft-lb (13 N-m) (**Figure 17-5, Page 17-6**).

NOTE

- MAKE SURE THERE IS AT LEAST A (MINIMUM) GAP OF 0.020 INCH (0.51 MM) BETWEEN EACH END OF THE MOUNTING PIN AND THE MOUNTING SCREW.

13. Install one drive button take-up spring.

13.1. Install spring on **right** side of any one of the three button mounting posts (when looking into the interior of the clutch cover with the rib at the twelve o'clock position) as shown (**Figure 17-15, Page 17-11**).

14. While compressing the take-up spring, install the drive button over the rib and take-up spring as shown (**Figure 17-8, Page 17-8**).

15. Install remaining two buttons.

16. Install a No. 10-24 button retaining screw with flat washer through each button and into the rib. Tighten the screws to 34 in-lb (3.8 N·m) (**Figure 17-9, Page 17-8**).

17. Install the thrust washer (11) onto the moveable face assembly (**Figure 17-5, Page 17-6**).

18. Install the hub assembly (1) on the moveable face assembly and align the match marks made before disassembling the clutch. Press the hub assembly on by hand (**Figure 17-5, Page 17-6**).

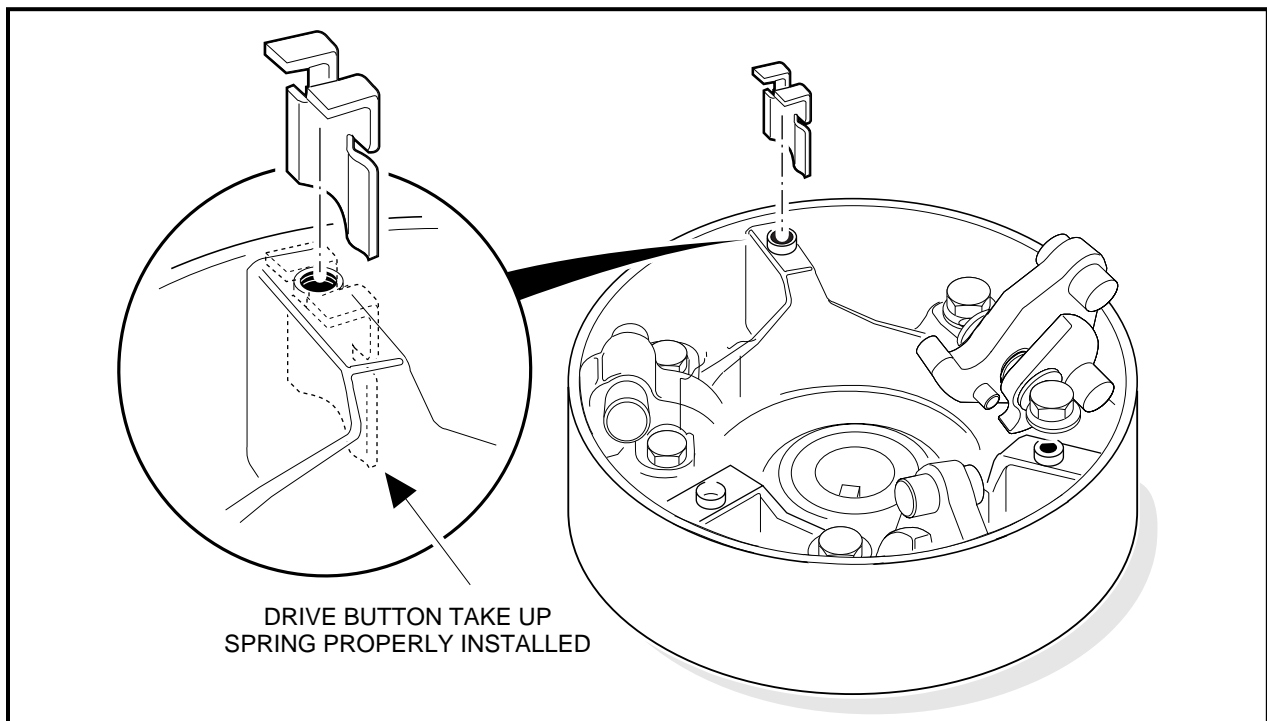


Figure 17-15 Correct Orientation of Drive Button Take-up Spring

DRIVE CLUTCH INSTALLATION

1. Place the drive clutch assembly on the crankshaft taper. Position the mounting washer (with the green side facing out) on the bolt (17) and start the bolt into the crankshaft. **See following NOTE.**

NOTE

- THE DRIVE CLUTCH MOUNTING BOLT HAS LEFT-HAND THREADS.

2. Tighten the drive clutch retaining bolt (17) to 25 ft-lb (33.9 N·m) (**Figure 17-5, Page 17-6**).

3. Install the starter/generator belt and adjust belt tension as instructed in Section 12 – Electrical System. Tighten the starter/generator mounting hardware to 23 ft-lb (31.2 N·m) and the adjusting hardware to 13 ft-lb (17.6 N·m).
4. Install the drive belt as instructed on page 17-4.
5. Connect the battery cables, positive (+) cable first.
6. Connect the spark plug wire to the plug.
7. Drive the vehicle and check for proper operation.

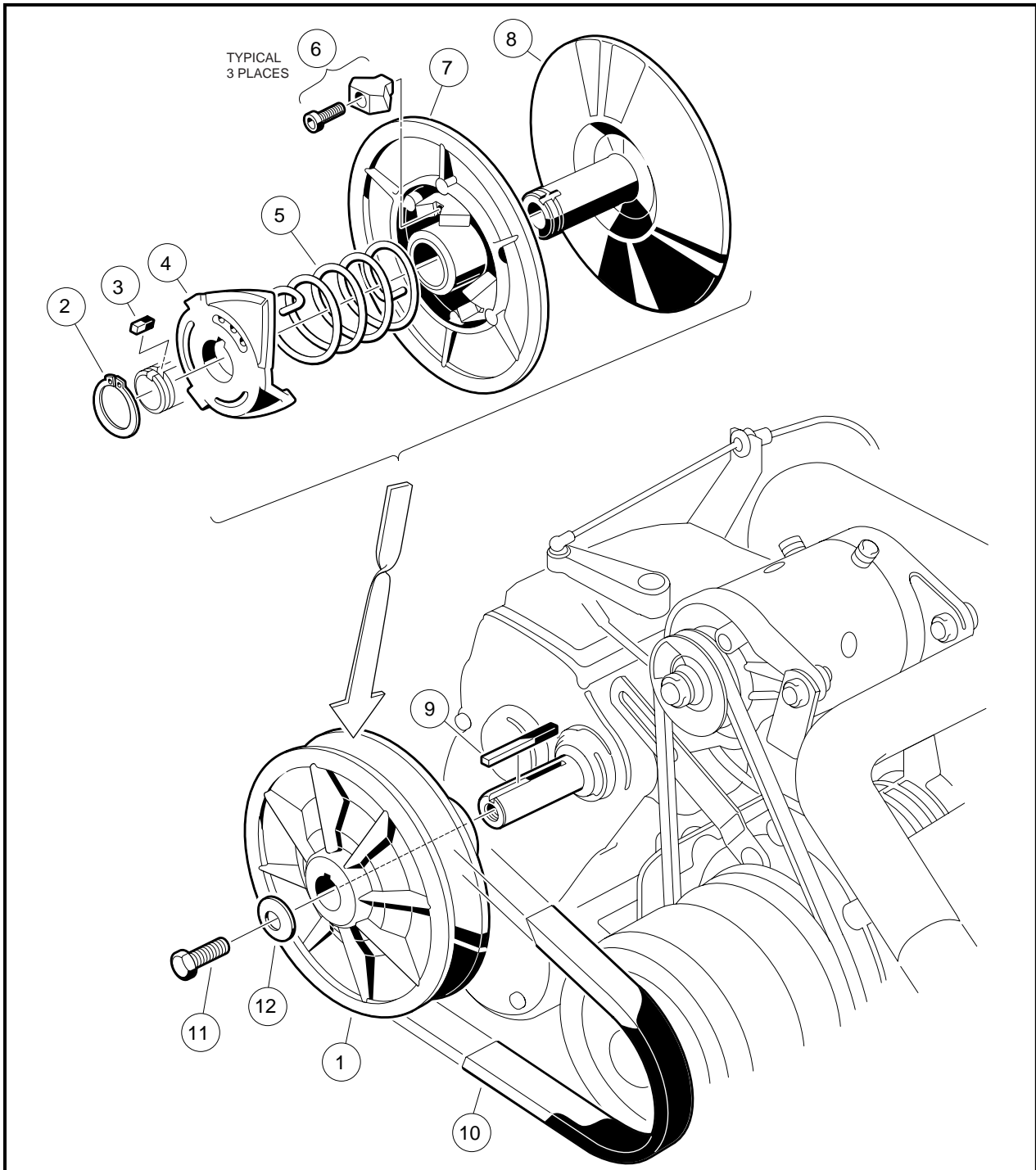


Figure 17-16 Driven Clutch Assembly

DRIVEN CLUTCH

Read **DANGER** and **WARNING** on page 17-1.

DRIVEN CLUTCH REMOVAL

1. Remove the drive belt as instructed on page 17-3.
2. Remove the bolt (11) and mounting washer (12) from the clutch shaft (**Figure 17-16, Page 17-12**).
3. Grasp the driven clutch assembly and slide it off the shaft.
4. Leave the key (9) in the keyway (**Figure 17-16, Page 17-12**).

DRIVEN CLUTCH DISASSEMBLY

1. Using external snap ring pliers, remove the retaining ring (4) (**Figure 17-17, Page 17-13**). See following **WARNING**.

⚠ WARNING

- DO NOT PLACE FINGERS UNDER THE CAM WHEN REMOVING THE CAM. THE MOVEABLE FACE MAY SPIN WHEN THE CAM BUTTONS RELEASE FROM THE CAM RAMPS, RESULTING IN SEVERE PERSONAL INJURY.

2. Insert a puller plug (Club Car Part No. 1014507) (**Figure 17-18, Page 17-13**) into the shaft bore and use a driven clutch cam puller (Club Car Part No. 1014508) to remove the cam (4) from the fixed face shaft (8) (**Figure 17-16, Page 17-12**).

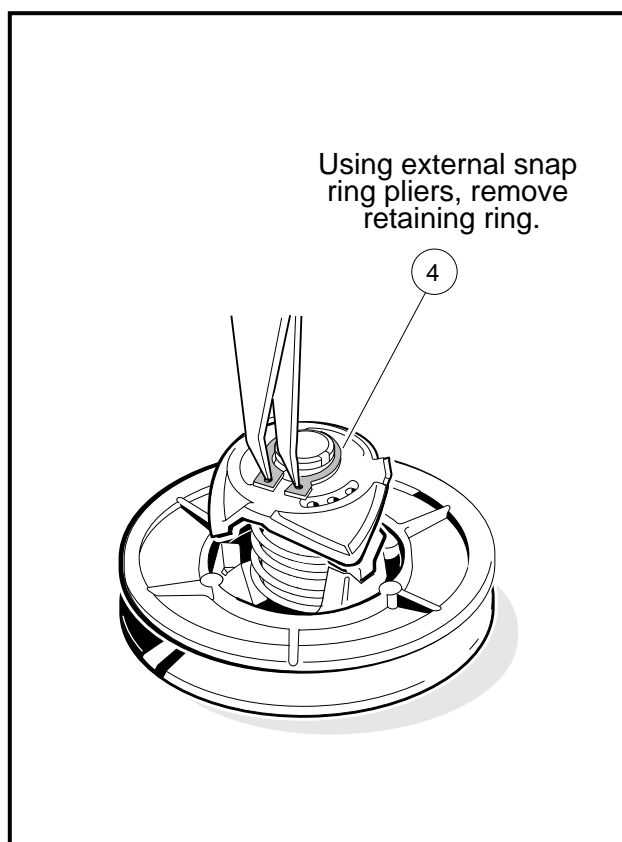


Figure 17-17 Remove Retaining Ring

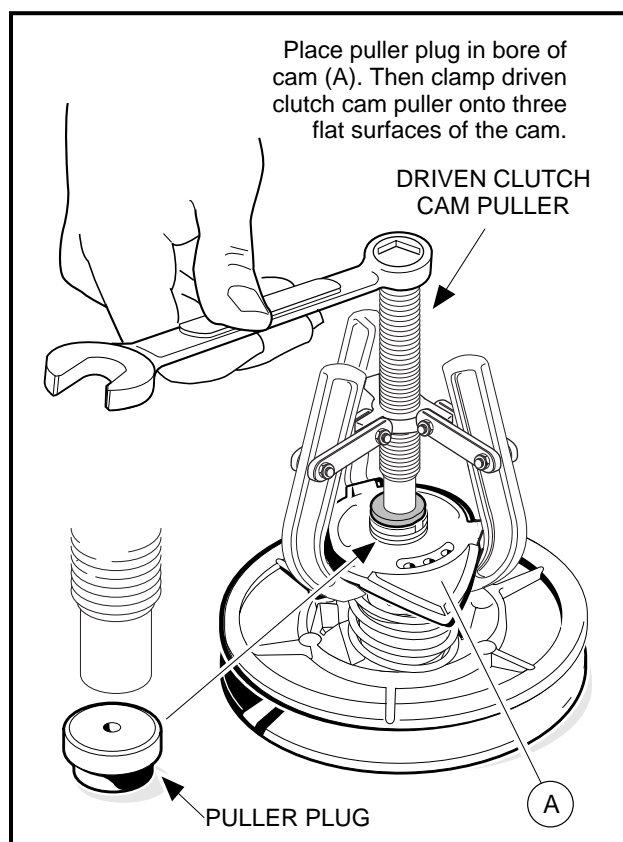


Figure 17-18 Driven Clutch Disassembly

Driven Clutch Disassembly, Continued:

3. Remove the spring (5) (**Figure 17-16, Page 17-12**).
4. Retain the key (3).
5. Slide the moveable face (7) off the fixed face shaft (8) (**Figure 17-16, Page 17-12**).

DRIVEN CLUTCH INSPECTION

1. Inspect the cam (4) for excessive wear. Replace it if necessary (**Figure 17-16, Page 17-12**).
2. Inspect the drive buttons (6) for excessive wear. Replace if necessary. To remove the drive buttons, remove the socket head cap screws and then the buttons (**Figure 17-16, Page 17-12**).
3. Inspect the smooth surface on the fixed and moveable face assemblies. Assemblies must be replaced if surfaces are worn more than 0.060 inch (1.5 mm).
4. Inspect the bronze bearing in the moveable face. If the bearing bore diameter is more than 1.384 inches (35.15 mm), the entire moveable face assembly must be replaced.
5. Inspect the shaft of the fixed face assembly. There should be no measurable wear. Replace the shaft if it is worn, scratched or damaged.

DRIVEN CLUTCH ASSEMBLY

1. Place the three drive buttons (6) in position. Apply one drop of Loctite® 222 to each of the socket head cap screws and then install and tighten them to 8 in-lb (0.9 N·m) (**Figure 17-16, Page 17-12**).
2. Slide the moveable face assembly (7) onto the fixed face shaft (8) (**Figure 17-16, Page 17-12**).
3. Place the end of the spring (5) into the hole in the moveable face assembly.
4. Install the key (3) into the keyway of the fixed face assembly (8) shaft (**Figure 17-16, Page 17-12**).
5. Holding the cam (4) in position for assembly on the shaft, install the other end of the spring (5) into the center spring hole of the cam. Rotate the cam until the keyway is aligned with the key (3) on the fixed face assembly, and then start the cam onto the shaft approximately 1/4 to 3/8 inch (6.3 to 9.5 mm).
6. Place the clutch assembly in a press and position the cam press tool (Club Car Part No. 101809101) on the cam as shown (**Figure 17-19, Page 17-14**).
7. Hold the fixed face assembly (3) and rotate the moveable face assembly (1) one-third turn **clockwise**, then press the cam (2) onto the fixed face assembly (**Figure 17-19, Page 17-14**).

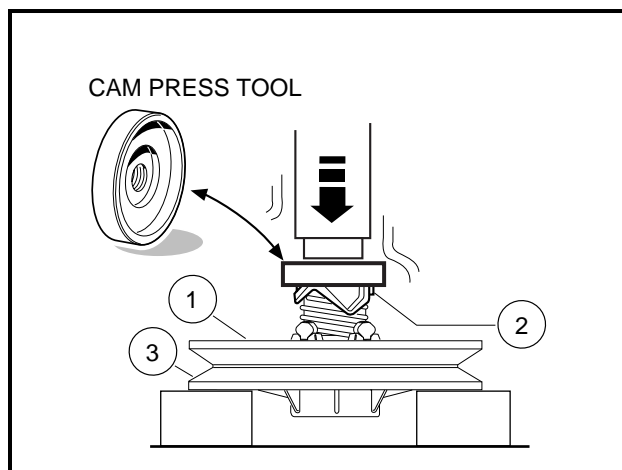


Figure 17-19 Cam Press Tool

8. Install the retaining ring (2) (**Figure 17-16, Page 17-12**). See following NOTE.

NOTE

- THE RETAINING RING CAN BE REUSED IF THE O.D. DOES NOT EXCEED 1.607 INCHES (40.82 MM). OTHERWISE IT MUST BE REPLACED WITH A NEW RING (CLUB CAR PART NO. 1014080).

9. While holding onto the cam, tap the end of the fixed face shaft lightly with a plastic mallet until the cam seats against the retaining ring. **See following CAUTION.**

⚠ CAUTION

- DO NOT USE A METAL HAMMER TO TAP THE FIXED FACE HUB. A METAL HAMMER WILL DAMAGE THE SHAFT.

DRIVEN CLUTCH INSTALLATION

1. To install the driven clutch, reverse the removal procedure. Before tightening the center bolt (11) to 14 ft-lb (19.0 N·m), make sure the mounting washer (12) is installed between the center bolt and the clutch (yellow side facing out) **(Figure 17-16, Page 17-12)**.

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